



PROJECT MANUAL  
FOR

**FIELD BUILDINGS**  
AT  
**CRESTWOOD HIGH SCHOOL**  
**1501 N. BEECH DALY ROAD**  
**DEARBORN HEIGHTS, MI 48127**

FOR  
**CRESTWOOD SCHOOL DISTRICT**  
**27235 JOY ROAD**  
**DEARBORN HEIGHTS, MI 48127**

PROJECT NO.: 5622

DATE: MARCH 20, 2023

This page intentionally left blank

**SECTION 00 0103  
PROJECT DIRECTORY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Identification of project team members and their contact information.

**1.02 OWNER:**

- A. Name: Crestwood School District.
1. Address Line 1: 27235 Joy Road.
  2. City: Dearborn Heights.
  3. State: Michigan.
  4. Zip Code: 48127.
  5. Telephone: (313) 378-2349.
- B. Primary Contact:
1. Title: Chief Financial Officer.
    - a. Name: Penny L. Morgan.
    - b. Email: pmorgan@csgm.k12.mi.us.

**1.03 CONSULTANTS:**

- A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
1. Company Name: Ehresman Associates, Inc. d/b/a Ehresman Architects.
    - a. Address Line 1: 803 W. Big Beaver Road Suite 350.
    - b. City: Troy.
    - c. State: Michigan.
    - d. Zip Code: 48084.
    - e. Telephone: (248) 244-9710.
  2. Primary Contact:
    - a. Title: Senior Architect, Partner.
    - b. Name: Elizabeth S. Bye.
    - c. Email: elizabeth@ehresmanarchitects.com.
  3. Secondary Contact:
    - a. Title: Architectural Staff
    - b. Name: Mackenzie Fisher
    - c. Email: mackenzie@ehresmanarchitects.com
- B. Civil Engineering Consultant:
1. Company Name: Spalding DeDecker Associates, Inc..
    - a. Address Line 1: 905 South Boulevard East.
    - b. City: Rochester.
    - c. State: Michigan.
    - d. Zip Code: 48307.
    - e. Telephone: (248) 844-6264.
    - f. Fax:(248) 844-5404.
  2. Primary Contact:
    - a. Title: Senior Project Manager / Vice President.
    - b. Name: Tom Sovel.
    - c. Email: tsovel@sda-eng.com.

- C. Structural Engineering Consultant:
  - 1. Company Name: IMEG.
    - a. Address Line 1: 33533 W. 12 Mile Road.
    - b. City: Farmington Hills.
    - c. State: Michigan.
    - d. Zip Code: 48331.
    - e. Telephone: (248) 344-2800.
    - f. Fax:(248) 344-1650.
  - 2. Primary Contact:
    - a. Title: Senior Structural Engineer.
    - b. Name: Mark Stevenson.
    - c. Email: Mark.B.Stevenson@imegcorp.com.
- D. Mechanical Engineering Consultant - HVAC/Plumbing:
  - 1. Company Name: Peter Basso Associates, Inc..
    - a. Address Line 1: 5145 Livernois, Suite 100.
    - b. City: Troy.
    - c. State: Michigan.
    - d. Zip Code: 48098.
    - e. Telephone: (248) 879-5666.
    - f. Fax:(248) 879-0007.
  - 2. Primary Contact:
    - a. Title: Project Lead Mechanical Engineer.
    - b. Name: Joe Giglio.
    - c. Email: jgiglio@pbanet.com.
- E. Electrical Engineering Consultant:
  - 1. Company Name: Peter Basso Associates, Inc..
    - a. Address Line 1: 5145 Livernois, Suite 100.
    - b. City: Troy.
    - c. State: Michigan.
    - d. Zip Code: 48098.
    - e. Telephone: (248) 879-5666.
    - f. Fax:(248) 879-0007.
  - 2. Primary Contact:
    - a. Title: Project Lead Electrical Engineer.
    - b. Name: Zachary Bussey.
    - c. Email: zbussey@pbanet.com.
- F. Technoloy Consultant:
  - 1. Company Name: Wright & Hunter.
    - a. Address Line 1: 818 West 11 Mile Road.
    - b. City: Royal Oak.
    - c. State: Michigan.
    - d. Zip Code: 48067.
    - e. Telephone: (248) 594-5850.
  - 2. Primary Contact:
    - a. Title: President & CEO.
    - b. Name: Scott Brune.
    - c. Email: sbrune@wriighthunter.com.

- G. Food Service Consultant:
1. Company Name: C.i.i. Food Service Design.
    - a. Address Line 1: 545-A North Saginaw Street.
    - b. City: Lapeer.
    - c. State: Mchigan.
    - d. Zip Code: 48446.
    - e. Telephone: (810) 667-3100.
  2. Primary Contact:
    - a. Title: President.
    - b. Name: Jim Petersen.
    - c. Email: jimp@ciifsd.com.

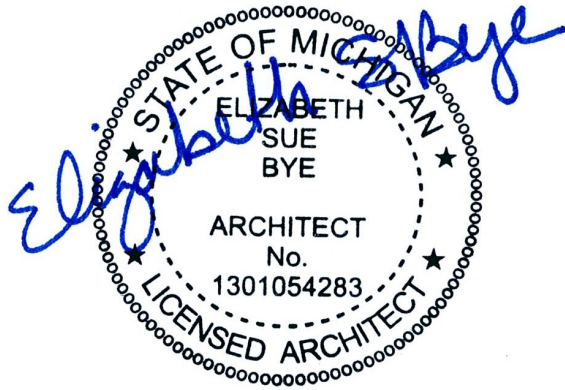
**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

This page intentionally left blank

**SECTION 00 0107  
SEALS PAGE**



**END OF SECTION**

This page intentionally left blank



**SECTION 00 0110  
TABLE OF CONTENTS**

**PROCUREMENT AND CONTRACTING REQUIREMENTS**

**1.01 DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS**

- A. Cover Page
- B. 00 0103 - Project Directory
- C. 00 0107 - Seals Page
- D. 00 0110 - Table of Contents
- E. 00 0115 - List of Drawing Sheets
- F. 00 1113 - Advertisement for Bids
- G. AIA Document A701-2018 "Instructions to Bidders"
- H. 00 3100 - Available Project Information
- I. Geotechnical Engineering Report
- J. 00 4100 - Bid Form
- K. Contractor Qualifications Form
- L. Familial Relationship Disclosure Form
- M. Affidavit of Compliance - Iran Economic Sanctions Act Form
- N. 00 4322 - Unit Prices Form
- O. 00 4323 - Alternates Form
- P. AIA A101-2017 "Standard Form of Agreement Between Owner & Contractor"
- Q. AIA A101-2017 Exhibit A "Insurance Bonds"
- R. AIA Document A201-2017 "General Conditions of the Contract for Construction"

**SPECIFICATIONS**

**2.01 DIVISION 01 -- GENERAL REQUIREMENTS**

- A. 01 1000 - Summary
- B. 01 2000 - Price and Payment Procedures
- C. Contractor List & Lien Waiver Checklist
- D. 01 2100 - Allowances
- E. 01 2200 - Unit Prices
- F. 01 2300 - Alternates
- G. 01 2500 - Substitution Procedures
- H. CSI / CSC Form 1.5C
- I. CSI / CSC Form 13.1A
- J. 01 3000 - Administrative Requirements
- K. Weekly Contractor Long Lead Item Checklist
- L. 01 4000 - Quality Requirements
- M. 01 4100 - Regulatory Requirements
- N. 01 5000 - Temporary Facilities and Controls
- O. 01 5100 - Temporary Utilities
- P. 01 6000 - Product Requirements

- Q. 01 6116 - Volatile Organic Compound (VOC) Content Restrictions
- R. 01 7000 - Execution and Closeout Requirements
- S. 01 7419 - Construction Waste Management and Disposal
- T. 01 7800 - Closeout Submittals

**2.02 DIVISION 02 -- EXISTING CONDITIONS**

- A. For Site Preparation and Earthwork, see Division 31
- B. 02 4100 - Demolition

**2.03 DIVISION 03 -- CONCRETE**

- A. 03 3000 - Cast-in-Place Concrete

**2.04 DIVISION 04 -- MASONRY**

- A. 04 2200 - Concrete Unit Masonry

**2.05 DIVISION 05 -- METALS**

- A. 05 1200 - Structural Steel Framing

**2.06 DIVISION 06 -- WOOD, PLASTICS, AND COMPOSITES**

- A. 06 1000 - Rough Carpentry
- B. 06 1753 - Shop-Fabricated Wood Trusses
- C. 06 2000 - Finish Carpentry

**2.07 DIVISION 07 -- THERMAL AND MOISTURE PROTECTION**

- A. 07 1300 - Sheet Waterproofing
- B. 07 2700 - Air Barriers
- C. 07 3113 - Asphalt Shingles
- D. 07 4616 - Aluminum Siding
- E. 07 6200 - Sheet Metal Flashing and Trim
- F. 07 9200 - Joint Sealants

**2.08 DIVISION 08 -- OPENINGS**

- A. 08 1213 - Hollow Metal Frames
- B. 08 1613 - Fiberglass Doors
- C. 08 3613 - Sectional Doors
- D. 08 5659 - Service and Teller Window Units
- E. 08 7100 - Door Hardware

**2.09 DIVISION 09 -- FINISHES**

- A. 09 2116 - Gypsum Board Assemblies
- B. 09 9000 - Painting and Coating - Commercial Facility Guide Specification - Sherwin-Williams
- C. 09 9600 - High-Performance Coatings

**2.10 DIVISION 10 -- SPECIALTIES**

- A. 10 1100 - Visual Display Units
- B. 10 1400 - Signage
- C. 10 2113.19 - Plastic Toilet Compartments
- D. 10 2800 - Toilet, Bath, and Laundry Accessories

**2.11 DIVISION 11 -- EQUIPMENT**

- A. 11 4011 - Food Service Equipment

**2.12 DIVISION 20 -- COMMON MECHANICAL REQUIREMENTS**

- A. 20 0500 - Mechanical General Requirements
- B. 20 0510 - Basic Mechanical Materials and Methods
- C. 20 0513 - Motors
- D. 20 0519 - Meters and Gages
- E. 20 0529 - Hangers and Supports
- F. 20 0547 - Mechanical Vibration Controls
- G. 20 0553 - Mechanical Identification
- H. 20 0700 - Mechanical Insulation

**2.13 DIVISION 22 -- PLUMBING**

- A. 22 0523 - General Duty Valves for Plumbing
- B. 22 1116 - Domestic Water Piping
- C. 22 1119 - Domestic Water Piping Specialties
- D. 22 1123 - Domestic Water Circulation Pumps
- E. 22 1124 - Domestic Water Piping Booster Pumps
- F. 22 1316 - Sanitary Waste And Vent Piping
- G. 22 1319 - Drainage Piping Specialties
- H. 22 1413 - Storm Drainage Piping
- I. 22 3300 - Electric Domestic Water Heaters
- J. 22 4200 - Plumbing Fixtures
- K. 22 4700 - Drinking Fountains, Water Coolers and Cuspidors

**2.14 DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)**

- A. 23 0500 - Common Work Result for HVAC
- B. 23 0593 - Testing, Adjusting, and Balancing
- C. 23 0933 - Temperature Controls
- D. 23 3113 - Metal Ducts
- E. 23 3300 - Duct Accessories
- F. 23 3423 - Power Ventilators
- G. 23 3433 - Air Curtains and Door Heaters
- H. 23 3713 - Diffusers, Registers, and Grilles
- I. 23 3723 - Air Intake and Relief Hoods
- J. 23 8229 - Electric and Hydronic Radiant Heating Cooling Units
- K. 23 8241 - Propeller Fan Unit Heaters - Steam, Hot Water, Electric
- L. 23 8244 - Centrifugal Fan Cabinet Unit Heaters (Electric)

**2.15 DIVISION 26 -- ELECTRICAL**

- A. 26 0010 - Electrical General Requirements
- B. 26 0519 - Conductors and Cables
- C. 26 0526 - Grounding and Bonding

- D. 26 0529 - Hangers and Supports for Electrical Systems
- E. 26 0533 - Raceway and Boxes
- F. 26 0543 - Underground Ducts and Utility Structures
- G. 26 0553 - Electrical Identification
- H. 26 0573 - Overcurrent Device Coordination Study/Arc Flash Hazard Analysis
- I. 26 0923 - Lighting Control Devices
- J. 26 0943 - Lighting Control Systems
- K. 26 2416 - Panelboards
- L. 26 2726 - Wiring Devices
- M. 26 2816 - Enclosed Switches And Circuit Breakers
- N. 26 2913 - Enclosed Controllers
- O. 26 5119 - LED Interior Lighting

**2.16 DIVISION 27 -- COMMUNICATIONS**

- A. 27 0143 - Communications Unit Price Sheet
- B. 27 1116 - Communications Cabinets, Racks, Frames, and Enclosures
- C. 27 1323 - Communications Optical Fibe Backbone Cabling
- D. 27 1513 - Communications Copper Horizontal Cabling

**2.17 DIVISION 31 -- EARTHWORK**

- A. 31 1000 - Site Clearing
- B. 31 1012 - Fine Grading
- C. 31 1018 - Soil Erosion Control
- D. 31 2000 - Earth Moving

**2.18 DIVISION 32 -- EXTERIOR IMPROVEMENTS**

- A. 32 1216 - Hot-Mix Asphalt Concrete Paving
- B. 32 1313 - Cement Concrete Pavements, Curbs, and Gutters
- C. 32 1373 - Concrete Paving Joint Sealants

**2.19 DIVISION 33 -- UTILITIES**

- A. 33 4100 - Storm Sewers, Underdrains and Drainage Structures

**END OF SECTION**

**SECTION 00 0115  
LIST OF DRAWING SHEETS**

**TTL      TITLE SHEET**  
**A0.00    GENERAL INFORMATION**  
**A0.01    CODE REVIEW PLAN**

**CIVIL DRAWINGS:**

**C1.0      GENERAL PLAN**  
**C1.1      TOPOGRAPHICAL SURVEY -AREA 1**  
**C1.2      TOPOGRAPHICAL SURVEY - AREA 2**  
**C1.3      TOPOGRAPHICAL SURVEY - STRUCTURE TABLE**

**C3.1      UTILITY PLAN - AREA 1**  
**C3.2      UTILITY PLAN - AREA 2**  
**C3.3      UTILITY PLAN - AREA 3**

**C4.1      PAVING AND LAYOUT PLAN - AREA 1**  
**C4.2      PAVING AND LAYOUT PLAN - AREA 2**

**C5.1      GRADING PLAN - AREA 1**  
**C5.2      GRADING PLAN - AREA 2**

**ARCHITECTURAL DRAWINGS:**

**A0.11      ARCHITECTURAL SITE PLAN & DETAILS**

**A1.11      REMOVALS FLOOR PLANS**  
**A1.14      REMOVALS CEILING PLAN - BUILDING B**  
**A1.15      REMOVALS ELEVATIONS - BUILDING A**  
**A1.16      REMOVALS ELEVATIONS - BUILDING B**

**A2.10      COMPOSITE FLOOR PLAN**  
**A2.11      FLOOR PLAN - BUILDING A**  
**A2.12      FLOOR PLAN - BUILDING B**  
**A2.13      DIMENSION PLAN - BUILDING A**  
**A2.14      DIMENSION PLAN - BUILDING B**

- A2.50 COMPOSITE ROOF PLAN**
  
- A2.60 WINDOW AND DOOR SCHEDULES**
  
- A3.00 EXTERIOR ELEVATIONS**
  - A3.01 EXTERIOR ELEVATIONS**
  
- A3.50 BUILDING SECTIONS -BUILDING A**
  - A3.51 BUILDING SECTIONS - BUILDING B**
  
- A5.00 INTERIOR ELEVATIONS - BUILDING A**
  - A5.01 INTERIOR ELEVATIONS - BUILDING B**
  
- A6.10 RCP AND DRAFTSTOPPING PLAN**
  
- A8.50 FINISH SCHEDULE**
  
- A9.00 EXTERIOR WALL SECTIONS - BUILDING A**
  - A9.01 EXTERIOR WALL SECTIONS - BUILDING A**
  - A9.02 EXTERIOR WALL SECTIONS - BUILDING B**
  - A9.03 EXTERIOR WALL SECTIONS - BUILDING B**
  
- A9.10 EXTERIOR DETAILS**
  - A9.11 EXTERIOR DETAILS**
  
- A9.50 INTERIOR WALL SECTIONS**

**STRUCTURAL DRAWINGS:**

- S01 GENERAL STRUCTURAL NOTES**
- S02 GENERAL STRUCTURAL NOTES**
- S03 SPECIAL INSPECTION SCHEDULE**
- S10 STRUCTURAL PLANS**
- S11 BUILDING PLAN & ELEVATIONS**
- S30 TYPICAL MASONRY DETAILS**
- S31 TYPICAL CONCRETE DETAILS**
- S32 SECTIONS AND DETAILS**

**MECHANICAL DRAWINGS:**

- M0.10 MECHANICAL STANDARDS AND DRAWING INDEX**
- M0.20 MECHANICAL COMPOSITE PLAN**
  
- M2.00 BUILDING A UNDERGROUND PLUMBING PLAN**
- M2.01 BUILDING B UNDERGROUND PLUMBING PLAN**
- M2.10 BUILDING A PLUMBING PLAN**
- M2.11 BUILDING B PLUMBING PLAN**
  
- M4.10 BUILDING A SHEET METAL PLAN**
- M4.11 BUILDING B SHEET METAL PLAN**
  
- M6.10 MECHANICAL DETAILS**
- M6.11 MECHANICAL DETAILS**
  
- M7.10 MECHANICAL SCHEDULES**
- M7.11 MECHANICAL SCHEDULES**
  
- M8-10 TEMPERATURE CONTROL STANDARDS AND GENERAL NOTES**

**ELECTRICAL DRAWINGS:**

- E0.10 ELECTRICAL STANDARDS AND DRAWING INDEX ELECTRICAL STANDARD SCHEDULES**
- E0.12 ELECTRICAL STANDARD SCHEDULES**
- E0.13 ELECTRICAL STANDARD SCHEDULES**
- E0.14 ELECTRICAL SITE PLAN**
  
- ED1.11 BUILDING B ELECTRICAL DEMOLITION PLAN**
  
- E2.10 BUILDING A LIGHTING PLAN**
- E2.11 BUILDING B LIGHTING PLAN**
  
- E3.10 BUILDING A POWER AND AUXILIARY SYSTEMS PLAN**
- E3.11 BUILDING B POWER AND AUXILIARY SYSTEMS PLAN**
  
- E5.10 ONE LINE DIAGRAM**
- E5.11 PANEL SCHEDULES**

**E7.10 ELECTRICAL DETAILS AND DIAGRAMS**

**TECHNOLOGY DRAWINGS:**

- T0.11 FIELD BUILDING COMMUNICATIONS SITE PLAN**
- T20.1 FIELD BUILDING STRUCTURED CABLING PLAN**
- T70.1 FIELD BUILDING STRUCTURED CABLING DETAILS**

**FOOD SERVICE DRAWINGS:**

- FS.1 FOOD SERVICE FLOOR PLAN AND SCHEDULE**
- FS.2 FOOD SERVICE UTILITIES**

**END OF SECTION**



**SECTION 00 1113  
ADVERTISEMENT FOR BIDS**

**FROM:**

**1.01 THE OWNER (HEREINAFTER REFERRED TO AS OWNER):**

- A. Crestwood School District
- B. Address:  
27235 Joy Road  
Dearborn Heights, MI, 48127

**1.02 AND THE ARCHITECT (HEREINAFTER REFERRED TO AS ARCHITECT):**

- A. Ehresman Associates, Inc. d/b/a Ehresman Architects
- B. Address:  
803 W. Big Beaver Road Suite 350  
Troy, MI 48084

**1.03 DATE: MARCH 20, 2023**

**1.04 TO: POTENTIAL BIDDERS**

- A. Your firm is invited to submit an offer to Owner for construction of a facility located at:  
Crestwood High School  
1501 N. Beech Daly Road  
Dearborn Heights, Michigan 48127  
Before 2:00 pm local standard time on the 4th day of April, 2023, for:
  - B. Project: Crestwood High School Field Buildings
  - C. Architect's Project Number: 5622
  - D. Project Description:
    - 1. Removal
      - a. Existing Cell Tower/Storage (Building A) – Removal of existing site paving, topsoil, fill material for construction of brick ledge foundation and building addition, exterior siding (evaluate condition of exterior sheathing), doors, frames & hardware, exterior mechanical and electrical as indicated on drawings. No interior work beyond replacement of exterior doors.
      - b. Existing Concessions/Storage (Building B) – Removal of existing site paving, topsoil, fill material for construction of brick ledge foundation, interior framing, ceilings, casework, doors, frames & hardware, mechanical and electrical as indicated on drawings.
    - 2. New Work
      - a. Home Field Building/Concessions (Building A) – Sitework, perimeter foundations for existing building brick ledge and door stoops, building addition foundations, face brick of existing building, masonry building addition, wood trusses, asphalt shingle roof (including existing), doors, frames & hardware, windows, food service equipment, restroom partitions and accessories, mechanical, plumbing, electrical as indicated on drawings.
      - b. Visitor Field Building (Building B) – Sitework, perimeter foundations for existing building brick ledge and door stoops, face brick of existing building, new masonry interior walls, roof overhang rework, asphalt shingle roof, doors, frames & hardware, restroom partitions and accessories, mechanical, plumbing, electrical as indicated on drawings.
  - E. Complete sets of the Bidding Documents for a Stipulated Sum contract and may be obtained at:

1. Engineering Reproduction, Inc. for viewing and purchase. 13550 Conant Avenue, Detroit, MI 48212. Telephone: (313) 366-3390.
2. Digital Documents may be requested from Ehresman Associates, Inc. d/b/a Ehresman Architects via **architects@ehresmanarchitects.com**.
3. Digital Documents are on display at the office of the following construction plan rooms:
  - a. Construction Associates of Michigan (CAM).
  - b. Dodge Data.
  - c. Construction Market Data (CMD).
  - d. Construction Data Company (CDC).
- F. Bidders will be required to provide Bid Security in the form of a Bid Bond valued at 5% of the proposer's maximum Bid Amount.
- G. Refer to other bidding requirements described in AIA Document A701-2018 Instructions to Bidders and Document 00 3100 - Available Project Information.
- H. Submit your offer on the Bid Form provided. Please submit one Bid Form for each Bid Pack. Bidders may supplement this form as appropriate. **Sealed bids are to be delivered to the Crestwood School District, 27235 Joy Road, Dearborn Heights, MI 48127**, at which time the bids will be opened and publicly read aloud.
- I. The Owner reserves the right to accept or reject any or all offers.
- J. The School Board will not consider, accept, or open a bid received after the date and time specified for bid submission in this advertisement for bid.
- K. The bids shall be accompanied by a completed Contractor Qualification Form.
- L. The bids shall be accompanied by a sworn and notarized statement disclosing any familial relationship that exists between the Owner or any employee of the bidder and any member of the Board of Education of the School District. The board will not accept a bid that does not include this sworn and notarized disclosure statement.
- M. The bids shall also be accompanied by a sworn and notarized Iran Economic Sanctions Certification. The Board will not accept a bid that does not include this sworn and notarized certification.
- N. A Performance Bond and Payment Bond in the full contract sum (100%) shall be provided by the Contractor and included in the Bid Amount.

#### 1.05 PROCUREMENT TIMETABLE

- A. **A MANDATORY PRE-BID MEETING** will be held for this project on **Tuesday, March 21, 2023 at 2:00 p.m. (local time)** at Crestwood High School at the Football Field Concession Building (please refer to attached map). Please email your intent to bid on the project to the Architects office at **architects@ehresmanarchitects.com**.
- B. Last Request for Information or Substitution Due: Tuesday, March 28, 2023 by 12:00 p.m.
- C. Last Addenda Issued: Wednesday, March 29, 2023 at 4:00 p.m.
- D. Bid Due Date: Tuesday, April 4, 2023, before 2:00 P.M.(EST) local time.
- E. Bid Opening: Same day and location at 2:00 P.M.(EST) local time.
- F. Bids May Not Be Withdrawn Until: 90 days after due date. Once the contract is executed, the bid price shall hold for the duration of the contract.
- G. Board of Education First Reading: Monday, April 17, 2023.
- H. Board of Education Anticipated Award Date: Monday, May 1, 2023 (if required).
- I. Contract Time: To be stated in bid documents.
- J. Submittals and Project Coordination: Immediately after Contract Execution.
- K. On-site Operations to Start: Immediately after Contract Execution.

- L. Desired Substantial Completion Date: Building A - Wednesday, September 27, 2023; Building B - Wednesday, August 30, 2023.
- M. Desired Final Completion Date: Building A - Wednesday, October 4, 2023; Building B - Wednesday, September 6, 2023.
- N. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time

**1.06 SIGNATURE**

- A. For: Crestwood School District
- B. By: Penny L. Morgan, Chief Financial Officer

**END OF SECTION**



Lawrence St

Whitefield St

Whitefield St

Beech Daly

Crestwood High School

Kinloch St

Kinloch St



Google Earth



# AIA® Document A701® – 2018

## Instructions to Bidders

for the following Project:  
*(Name, location, and detailed description)*

Crestwood School District - Crestwood High School Field Buildings  
1501 N. Beech Daly Road  
Dearborn Heights, MI 48127

**THE OWNER:**  
*(Name, legal status, address, and other information)*

Crestwood School District  
27235 Joy Road  
Dearborn Heights, MI 48127  
Telephone Number: (313) 278-0906

**THE ARCHITECT:**  
*(Name, legal status, address, and other information)*

Ehresman Associates, Inc. d/b/a Ehresman Architects  
803 West Big Beaver Road  
Suite 350  
Troy, MI 48084  
Telephone Number: 248-244-9710  
Fax Number: 248-244-9712

### TABLE OF ARTICLES

- 1      **DEFINITIONS**
- 2      **BIDDER’S REPRESENTATIONS**
- 3      **BIDDING DOCUMENTS**
- 4      **BIDDING PROCEDURES**
- 5      **CONSIDERATION OF BIDS**
- 6      **POST-BID INFORMATION**
- 7      **PERFORMANCE BOND AND PAYMENT BOND**
- 8      **ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS**

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

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner’s Instructions to the Architect, Parts A and B will be completed prior to using this document.

## ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

## ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.
- .7 Contractor has been regularly engaged in this business for at least seven (7) years, and has successfully completed at least three (3) projects of similar scope, size, and costs. Provide a list of references and completed projects with telephone number and name of contact person with 24 hours of request, and on space provided on the Proposal form.**
- .8 COST OF PERMITS AND FEES. Bidder has included the following**
  - .1 State Permits, Fees. The Base Proposal Amount shall include the cost of the building permit and all other permits, governmental fees, licenses, inspections and related work necessary for the proper execution of the work of the Contract, including:**

a. Bureau of Fire Services

b. Bureau of Construction Codes

Do not include in the Proposal Amount the following fees already paid for by the Owner.

a. Plan Review Fees

For further information on fees and inspections, contact the State of Michigan at 517-241-9313.

## ARTICLE 3 BIDDING DOCUMENTS

### § 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)*

Contractors can request bidding documents by emailing [architects@ehresmanarchitects.com](mailto:architects@ehresmanarchitects.com).

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

### § 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)*

Contractors shall submit bidding RFI's to [architects@ehresmanarchitects.com](mailto:architects@ehresmanarchitects.com) prior to 12:00 p.m. (EST) on Tuesday, March 28, 2023. All requests shall clearly and thoroughly describe the item or issue requiring clarification.

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

### § 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution. Notwithstanding the foregoing, the name of a model, manufacturer or brand specifically listed in this Project Manual shall not be considered exclusive of other models, manufacturers or brands; however, models, manufacturers and brands specified in this Project Manual are preferred. The Owner expects all supplies, materials, equipment or products bid by a Contractor to meet or exceed the Specifications set forth in this Project Manual. Further, it is the Owner's intent that this Project Manual permit competition. Accordingly, the use of any patent, proprietary name or manufacturer's name is for demonstrative purposes only and is not intended to curtail competition. Whenever any supplies, material, equipment or products requested in this Project Manual are specified by patent, proprietary name or by the name of the manufacturer, unless stated differently, such specification shall be considered as if followed by the words "or comparable equivalent," whether or not such words appear. The Owner in its sole and absolute discretion, shall have the right to determine if the proposed equivalent products/brands submitted by the Contractor meet the Specifications contained in this Project Manual and possess

equivalent and/or better qualities. It is the Contractor's responsibility to notify the Owner in writing if any Specifications or suggested comparable equivalent products/brands require clarification by the Owner. Any and all deviations from Specifications must be also noted on the Proposal Form. This language applies to this provision as well as any and all other provisions within the Project Manual, including the Specifications, which identifies a specific model, manufacturer or brand.

### **§ 3.3.2 Substitution Process**

**§ 3.3.2.1** Written requests for substitutions shall be received by the Architect at least ~~ten~~ seven (7) days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

**§ 3.3.2.2** Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

**§ 3.3.2.3** If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

**§ 3.3.3** The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

**§ 3.3.4** If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

**§ 3.3.5** No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

### **§ 3.4 Addenda**

**§ 3.4.1** Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

*(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)*

All addenda will be issued to Contractors known to have plans via email prior to 4:00 p.m. (EST) on Wednesday, March 29, 2023. All addenda will also be posted to the required state website (Sigma).

**§ 3.4.2** Addenda will be available where Bidding Documents are on file.

**§ 3.4.3** Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

**§ 3.4.4** Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

## **ARTICLE 4 BIDDING PROCEDURES**

### **§ 4.1 Preparation of Bids**

**§ 4.1.1** Bids shall be submitted on the forms included with or identified in the Bidding Documents.

**§ 4.1.2** All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

**§ 4.1.3** Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

**§ 4.1.4** Edits to entries made on paper bid forms must be initialed by the signer of the Bid.



§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

#### § 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

*(Insert the form and amount of bid security.)*

As indicated in Specification Section 00 1113 "Advertisement for Bids" and in 4.2.5 below.

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginning 90 days after the opening of Bids, withdraw its Bid and request the return of its bid security.

#### § 4.3 Submission of Bids

§ 4.2.5 Proposal Guarantee (Bid Bond) The successful bidder's bid guarantee will be retained until it has signed the Contract and furnished the required payment and performance bonds. The Owner reserves the right to retain the security of the next two lowest bidders for each contract until the lowest bidder enters into contract, or until ninety (90) days after the bid opening, whichever is the shorter. All other bid securities will be returned as soon as practicable. If any bidder refuses to enter into a Contract, the Owner will retain its Bid Security as liquidated damages, but not as a penalty. Form: Certified check, bank money order, or surety bond. § 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

*(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)*

Refer to Section 4.3.6 below

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.3.6 Submit two (2) hard copies of the bid forms prior to 2:00 p.m. on Tuesday, April 4, 2023. Provide an electronic copy (flash drive) of the entire Proposal including, but not limited to: the Proposal Form, Contractor Qualifications Form, Bid Security, Familial Relationship Disclosure Form, Affidavit of Compliance - Iran Economic Sanctions Act Form, Unit Prices Form (if any), and Alternates Form (if any). If a flash drive is not included, please email a copy of the bid documents to architects@chresmanarchitects.com before noon on Wednesday, April 5, 2023.

§ 4.3.7 Bids will be opened publicly and read aloud.

#### § 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:

*(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)*

### ARTICLE 5 CONSIDERATION OF BIDS

#### § 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. ~~A summary of the Bids may be made available to Bidders aloud.~~

#### § 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.2.1. Bids are considered irregular and may be rejected for any of the following reasons unless otherwise provided by law:

1. If Bid Proposal Form furnished is not used or is altered.
2. If there are unauthorized additions, qualified or conditional Bids, or irregularities of any kind which make the Bid incomplete, indefinite, or ambiguous as to its meaning.
3. If Bidder adds any provisions reserving right to accept or reject any award, or enter into Contract pursuant to an award.
4. If Lump Sum, Unit Prices, or Alternates contained in the Bid Proposal are obviously unbalanced either in excess or, or below, reasonable cost analysis values.
5. If Bidder fails to complete Bid form in any other particulars where information is requested so Bid form may be properly evaluated.

6. Bidder is deemed to not be the lowest Responsive, Responsible Bidder by definition and prevailing status.
7. Bidder's qualifications and level of performance on past projects is deemed unacceptable by the Owner, at its sole discretion.
8. Bidders proposed substantial and/or final completion date does not meet the Owner's best interest in its' sole judgment.
9. Owner reserve the right to reject any Bid, at their sole discretion, except where otherwise provided by law in the case of Public Work.
10. If Bid Proposal is not accompanied by a required bid security or by other data required by the Bidding Documents, or by a bid which is in any way incomplete or irregular is subject to the rejection, including the low bid.

**§ 5.2.2. By submitting a proposal, each bidder agrees to waive any claim it has or may have against the Owner, the Architect-Engineer, and their respective employees, arising out of, or in connection with, the administration, evaluation, or recommendation of any bid.**

### **§ 5.3 Acceptance of Bid (Award)**

**§ 5.3.1** It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

**§ 5.3.2** Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

**§ 5.3.3** In determining the lowest responsible Bidder, the Owner will consider the proposal amount, the qualifications, and contractor's level of performance on past projects for this Owner or other Owners, the timeliness of the proposal as based on the stated completion dates and the Owner's evaluation of the contractor's schedule performance on prior projects.

**§ 5.3.4** The Owner reserves the right to accept or reject any and all Bid Proposals, either in whole or in part, to waive any informalities or irregularities therein, or to award the contract to other than the contractor(s) submitting the best financial Bid Proposal (low bidder) in its sole and absolute discretion.

## **ARTICLE 6 POST-BID INFORMATION**

### **§ 6.1 Contractor's Qualification Statement**

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

#### **§ 6.1.1. Subcontractor's Qualifications**

- a. Submit a list of major subcontractors, within 48 hours if requested by Owner.
- b. Submit a detailed trade cost breakdown for major subcontractors and equipment, within 72 hours if requested by Owner.

### **§ 6.2 Owner's Financial Capability**

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

### **§ 6.3 Submittals**

**§ 6.3.1** After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

- 3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

## ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

### § 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a Michigan A.M. Best company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

*(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)*

A Performance Bond and Payment Bond in the full contract sum (100%) shall be provided by the Contractor.

### § 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

## ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, ~~unless otherwise stated below~~ as modified for the Project.  
*(Insert the complete AIA Document number, including year, and Document title.)*

**.2** AIA Document A101™–2017, Exhibit A, Insurance and Bonds, ~~unless otherwise stated below as modified for the Project.~~  
(Insert the complete AIA Document number, including year, and Document title.)

**.3** AIA Document A201™–2017, General Conditions of the Contract for Construction, ~~unless otherwise stated below as modified for the Project.~~  
(Insert the complete AIA Document number, including year, and Document title.)

~~**.4** AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:  
(Insert the date of the E203–2013.)~~

**.5** Drawings  
Refer to Section 00 0115 of the Project Manual in addition to the Title Sheet of the drawing set.

Number	Title	Date
--------	-------	------

**.6** Specifications  
Refer to the Project Manual Table of Contents.

Section	Title	Date	Pages
---------	-------	------	-------

**.7** Addenda:

Number	Date	Pages
--------	------	-------

~~**.8** Other Exhibits:  
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)~~

~~AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:  
(Insert the date of the E204–2017.)~~

~~—~~

~~The Sustainability Plan:~~

Title	Date	Pages
-------	------	-------

~~Supplementary and other Conditions of the Contract:~~

Document	Title	Date	Pages
----------	-------	------	-------

**.9** Other documents listed below:  
(List here any additional documents that are intended to form part of the Proposed Contract Documents.)



## **Certification of Document's Authenticity**

**AIA® Document D401™ – 2003**

I, \_\_\_\_\_, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with this certification at 13:50:06 ET on 03/20/2023 under Order No. 2114348013 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 2018, Instructions to Bidders, other than changes shown in the attached final document by underscoring added text and striking over deleted text.

---

*(Signed)*

---

*(Title)*

---

*(Dated)*

This page intentionally left blank



**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 Engineering Report - SME Project No. 088984.00, dated May 19, 2022.
  - 1. A copy is available for inspection within this document. NOTE: This report includes multiple projects. Please only refer to the data regarding this building.
  - 2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
  - 3. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
  - 4. 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 Price accruing to Owner.

**PART 2 PRODUCTS (NOT USED)**

**PART 3 EXECUTION (NOT USED)**

**END OF SECTION**

This page intentionally left blank



# GEOTECHNICAL ENGINEERING REPORT

CRESTWOOD HIGH SCHOOL ATHLETIC FIELD  
DEARBORN HEIGHTS, MICHIGAN

SME Project Number: 088984.00  
MAY 19, 2022





15825 Leone Drive  
Macomb, MI 48042

T (586) 731-3100

[www.sme-usa.com](http://www.sme-usa.com)

May 19, 2022

Ms. Elizabeth S. Bye  
Senior Architect, Partner  
Ehresman Architects  
803 West Big Beaver Road  
Troy, Michigan 48084

Via e-mail: [Elizabeth@ehresmanarchitects.com](mailto:Elizabeth@ehresmanarchitects.com) (PDF file)

RE: Geotechnical Engineering Report  
Crestwood High School Athletic Field  
Dearborn Heights, Michigan  
SME Project No. 088984.00

Dear Ms. Bye:

We have completed our geotechnical evaluation for the Crestwood High School athletic field improvements and parking lot expansion in Dearborn Heights, Michigan. This report presents our geotechnical recommendations for site preparation, earthwork improvements, subgrade preparation, and foundation recommendations. Additionally, our report presents a discussion regarding construction considerations related to the geotechnical conditions disclosed by the borings.

We appreciate the opportunity to be of service. If you have questions, would like to discuss our findings, or require additional information, please contact us.

Sincerely,

**SME**

A handwritten signature in blue ink that reads "Laurel M. Johnson".

Laurel Johnson  
May 19 2022 2:04 PM

Laurel M. Johnson, PE  
Senior Consultant

# TABLE OF CONTENTS

- 1. INTRODUCTION ..... 1
  - 1.1 EXISTING SITE CONDITIONS ..... 1
  - 1.2 PROJECT DESCRIPTION..... 2
- 2. EVALUATION PROCEDURES..... 2
  - 2.1 FIELD EXPLORATION ..... 2
  - 2.2 LABORATORY TESTING ..... 3
- 3. SUBSURFACE CONDITIONS ..... 3
  - 3.1 ATHLETIC FIELD (HA-1 THROUGH HA-10)..... 3
  - 3.2 ALTHLETIC COMPLEX (B1 THROUGH B5) ..... 3
  - 3.3 PARKING LOTS (B6 THROUGH B9)..... 4
  - 3.4 GENERAL COMMENTS ..... 4
- 4. ANALYSIS AND RECOMMENDATIONS ..... 4
  - 4.1 SITE PREPARATION AND EARTHWORK ..... 4
    - 4.1.1 EXISTING FILL/NEAR SURFACE SOIL CONSIDERATIONS ..... 4
    - 4.1.2 GENERAL SITE SUBGRADE PREPARATION ..... 5
    - 4.1.3 ENGINEERED FILL REQUIREMENTS ..... 6
    - 4.1.4 SUBGRADE PREPARATION FOR FLOOR SLABS..... 6
  - 4.2 FOUNDATION RECOMMENDATIONS ..... 7
  - 4.3 SYNTHETIC TURF RECOMMENDATIONS..... 9
  - 4.4 SEISMIC SITE CLASS ..... 10
  - 4.5 CONSTRUCTION CONSIDERATIONS ..... 10
- 5. SIGNATURES ..... 11

## APPENDIX A

- BORING LOCATION PLANS (FIGS. 1 THROUGH 4)
- BORING LOG TERMINOLOGY
- BORING LOGS (B1 THROUGH B9 & HA-1 THROUGH HA-10)
- USACE DCP DATA SHEETS (HA-1 THROUGH HA-10)

## APPENDIX B

- IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT
- GENERAL COMMENTS
- LABORATORY TESTING PROCEDURES

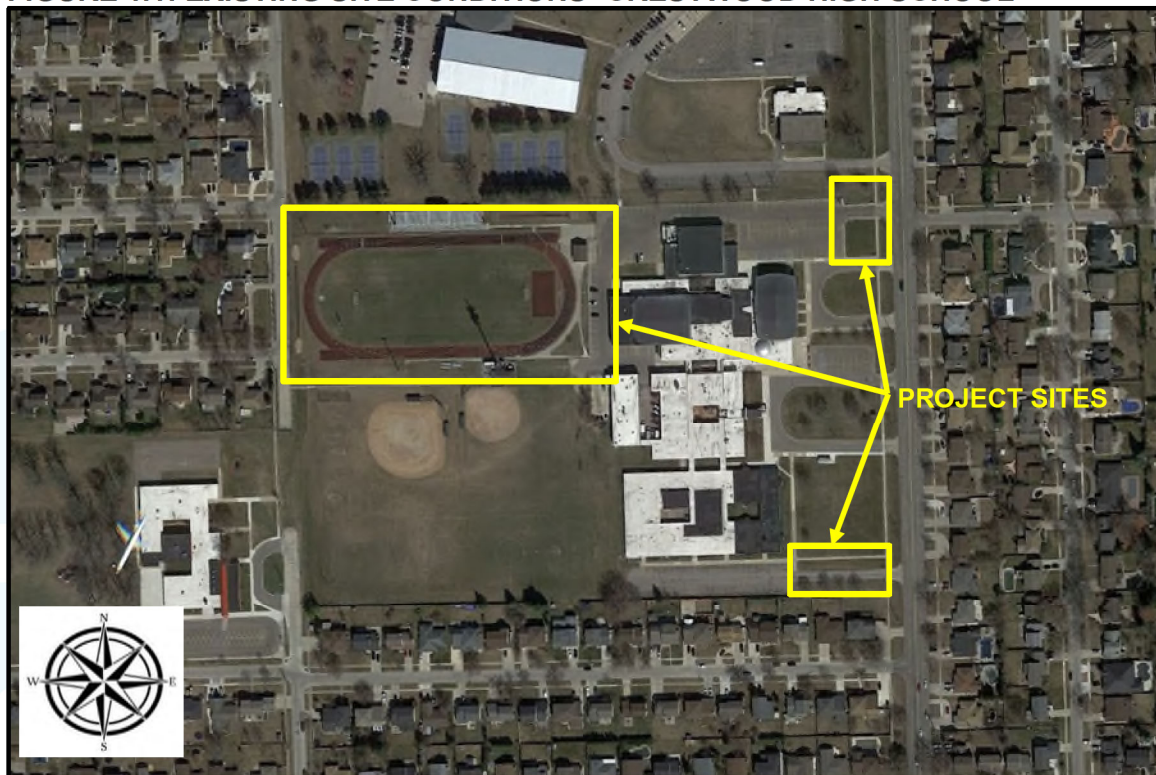
# 1. INTRODUCTION

This report presents the results of the geotechnical evaluation performed by SME at Crestwood High School in Dearborn Heights, Michigan. The evaluation was conducted in general accordance with the scope of services outlined in SME Proposal No. P00923.22 dated March 23, 2022; however, we were unable to access borings B2 and B3 with the truck-mounted drill rig due to lateral clearance. Borings were manually advanced at these locations.

## 1.1 EXISTING SITE CONDITIONS

Crestwood High School is located at 1501 North Beech Daly Road in Dearborn Heights, Michigan. The facility is located within a residential neighborhood, with Canfield Community Center and Central Park positioned to the north and Kinloch Elementary School positioned to the west. The educational facility occupies the eastern half of the property and the athletic complex occupies the western half of the property. Hot mix asphalt surfaced parking lots are located to the north, south, and east of the school building with access drives extending to North Beech Daly Road. The athletic facility consists of a baseball field, softball field, and a multi-purpose athletic field with a rubberized asphalt track. The natural turf athletic field has a home grandstand to the north and the visitor grandstand to the south. Sidewalks, fencing, field lighting, and a cellular tower are also present on the site. Based on the *Topographical Survey* prepared by Spalding DeDecker, ground surface elevations at the project site range from approximate elevation 620 feet to 625 feet (USGS). Refer to Figure 1.1 for additional information.

**FIGURE 1.1: EXISTING SITE CONDITIONS- CRESTWOOD HIGH SCHOOL**



## 1.2 PROJECT DESCRIPTION

Crestwood School District is planning to improve the existing athletic complex and expand existing parking lots. The improvements to the athletic field will include a synthetic turf athletic field, a new track, a new concessions/team building, and grandstands. The single-story building and grandstands will be supported by shallow foundations. We expect column loads of less than 150 kips and continuous wall loads of about 2.5 kips per lineal foot or less.

The northern and southern parking lots are planned for expansion between Beech Daly Road and the existing parking lots. New sidewalks will also be constructed.

Finish floor elevations (FFE) and design pavement grades were not provided at the time this report was written; however, based on existing site grades, we anticipate cuts and/or fills of less than two feet will be required.

Contact SME if project parameters vary from those described above.

## 2. EVALUATION PROCEDURES

### 2.1 FIELD EXPLORATION

The number, depths, and locations of the borings were jointly determined by Ehresman Architects and SME. SME located the borings in the field by measuring from existing site features. The borings were performed at the approximate locations indicated on the Boring Location Plans (Figures 1 – 4) included in Appendix A.

SME advanced a total of seven borings (B1 and B4 through B9) at the project site on May 4, 2022. We drilled the borings with a rotary-type truck-mounted drill rig. Solid stem augers were used, and we collected samples using the Split-Barrel Sampling procedure. The Standard Penetration Test (SPT)  $N_{60}$ -values shown on the boring logs represent a modified N-value based on the correlation between the recorded SPT value and the measured hammer efficiency of the testing equipment (also shown on the boring logs). We were unable to access borings B2 and B3 with the truck-mounted drill rig due to insufficient lateral clearance along the access path. Therefore; the borings were manually advanced on May 6, 2022. Borings B1 through B5 extended to a depth of 15 feet below the ground surface and borings B6 through B9 extended to a depth of 10 feet below the ground surface.

We originally planned to perform the hand auger borings for the synthetic turf field and the track concurrently with the other borings. However, the facilities manager requested that we postpone the sampling on the field due to a soccer game scheduled for the evening of May 4, 2022. Borings HA-1 through HA-10 were manually advanced to depths of 4.5 to 5 feet below the ground surface on May 5, 2022.

The manually advanced borings were advanced using a 3-inch diameter bucket auger, and we collected representative samples of each soil stratum encountered. Prior to performing the athletic field borings, we advanced a United States Army Corps of Engineers (USACE) dynamic cone penetrometer (DCP) to a depth of approximately 1 meter. The DCP consists of a dual-weight slide hammer driving a conical-tipped rod. The Corps of Engineers has developed correlations between blow counts and California Bearing Ratio (CBR). Refer to the appended *USACE DCP Data Sheets* for additional information.

We obtained groundwater levels during and upon completion of drilling at the boring locations and backfilled the boreholes with excavated soils. Borings drilled in existing pavements were patched at the surface with asphalt cold patch. We did not obtain long-term groundwater levels from the borings, nor did we obtain ground surface elevations at the boring locations.

The SME drillers and field representative sealed recovered samples from the borings in glass jars or plastic bags and delivered them to our laboratory for additional analysis.

## 2.2 LABORATORY TESTING

The laboratory testing program consisted of visual soil classification on recovered samples along with moisture content and hand penetrometer tests on portions of cohesive samples obtained. The Laboratory Testing Procedures in Appendix B provide descriptions of the laboratory tests discussed above.

Upon completion of the laboratory testing, we prepared boring logs that include materials encountered, penetration resistances, pertinent field observations made during the drilling operations, and the results of certain laboratory tests. The boring logs are included in Appendix A. We developed the soil descriptions from both visual classification and the results of laboratory tests, where applicable.

Soil samples retained over a long time, even sealed in jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, we retain soil samples in our laboratory for 60 days and then dispose, unless instructed otherwise.

## 3. SUBSURFACE CONDITIONS

We summarize the general soil and groundwater profiles at each project site in the following sections.

### 3.1 ATHLETIC FIELD (HA-1 THROUGH HA-10)

We encountered eight to 24 inches of topsoil over native clays that extended to the explored depths of the borings. We obtained shear strengths in the native clays ranging from 2.0 to 3.0 kips per square foot, and corresponding moisture contents of 21 to 28 percent, indicating a very stiff condition. The shear strengths and moisture contents indicate the presence of lean-to-fat clays at the boring locations. Based on the DCP probes, most of the near-surface subgrade is considered poor (CBRs of 3 to 5 percent) to very poor (CBRs of less than 3 percent).

Groundwater was not encountered before or during drilling operations at the boring locations. However, perched water/light seepage conditions were encountered within sand seams at some of the boring locations.

### 3.2 ALTHLETIC COMPLEX (B1 THROUGH B5)

We encountered three to 14 inches of topsoil over native clays that extended to the explored depths of the borings. We obtained shear strengths in the native clays ranging from 1.5 to greater than 4.5 ksf, and corresponding moisture contents of 14 to 30 percent, indicating a stiff to hard condition. Based on visual review and the high shear strengths and moisture contents, some of the near-surface clays are considered lean-to-fat and are more sensitive to volume changes with changes in moisture content.

We encountered groundwater at only one of the borings (B1), at a depth of 3 feet (elevation 620 feet) during drilling, and 11 feet (elevation 612 feet) after drilling. Based on a color change from brown to gray, we expect long-term groundwater levels occur at about 8.0 to 12.0 feet below the existing ground surface, or between elevations 610 feet and 615 feet. It appears groundwater above this level is perched in granular soil seams or layers overlying the low permeability natural clays.



### 3.3 PARKING LOTS (B6 THROUGH B9)

We encountered four inches of topsoil at borings B6 and B7, and four inches of hot mix asphalt over five to six inches of aggregate base at borings B8 and B9. Below the surficial materials at boring B6, we encountered three feet of clay fill. We obtained a shear strength of 1.75 ksf, and a corresponding moisture content of 25 percent in the clay fill, indicating a stiff condition.

Below the fill and surficial materials, we encountered native clays that extended to the explored depths of the borings. We obtained shear strengths in the native clays ranging from 1.25 to greater than 4.5 ksf, and corresponding moisture contents of 10 to 35 percent, indicating a stiff to hard condition. The shear strengths and moisture contents indicate the presence of lean-to-fat clays at some of the borings.

Groundwater was not encountered before or during drilling operations at the boring locations. However, perched water conditions were encountered within sand seams. Based on a color change from brown to gray, we expect long-term groundwater levels occur at about 8.0 feet below the existing ground surface, or between elevations 614.5 feet to 616.5 feet. It appears groundwater above this level is perched in granular soil seams or layers overlying the low permeability natural clays.

### 3.4 GENERAL COMMENTS

The soil profiles described herein and depicted on the boring logs are generalized descriptions of the conditions encountered. The stratification depths shown on the boring logs and described herein indicate a zone of transition from one soil type to another and are not exact depths of change from one soil type to another. Soil conditions may be different in areas other than at the boring locations. Refer to the boring logs for the soil and groundwater conditions at the specific boring locations. We base the soil descriptions on visual classification of the soils encountered. Expect hydrostatic groundwater levels and the volume of groundwater, especially from perched or trapped groundwater source(s), to fluctuate throughout the year, based on variations in precipitation, evaporation, surface runoff, and other factors. The groundwater levels indicated by the borings and presented in this section represent conditions when we advanced the borings. The groundwater levels at the time of construction may vary. Consider thickness measurements of surficial materials reported on the boring logs (e.g., gravel, asphalt, topsoil, etc.) approximate since mixing of these materials can occur in small diameter boreholes. Therefore, if accurate thickness measurements are required for inclusion in bid documents or purposes of design, perform additional evaluations such as shallow test pits.

It is sometimes difficult to distinguish between fill and natural soils based on samples and cuttings from small-diameter boreholes, especially when portions of the fill do not contain man-made materials, debris, topsoil or organic layers, and when the fill appears similar in composition to the local natural soils. Therefore, consider the delineation of fill described above and on the appended boring logs approximate only. Review former site topography plans, aerial photographs, and other historic site records and excavate test pits if a more comprehensive evaluation of the extent and composition of the fill is required.

## 4. ANALYSIS AND RECOMMENDATIONS

### 4.1 SITE PREPARATION AND EARTHWORK

#### 4.1.1 EXISTING FILL/NEAR SURFACE SOIL CONSIDERATIONS

We encountered fill soils that extended to 3.0 feet below the ground surface at boring B6, which is within the northern parking lot expansion. The shear strengths of the fill clays are similar to those obtained in the native clays. The fill appears to have been placed in a controlled manner, and we consider it suitable for support of engineered fill and pavements if properly prepared as outlined in this report.

We encountered near-surface, lean-to-fat clays at most of the boring locations that generally extended about five to seven feet below the ground surface. Lean-to-fat clays have a moderate potential to expand or shrink when exposed to moisture changes. Following stripping and grubbing of building pads, place a 4-inch layer of 21AA crushed aggregate on the exposed surface to protect the subgrade prior to placing slabs-on-grade. If the building is enclosed and heated over the winter without first placing slabs-on-grade, properly moisture condition the clay subgrade prior to placing floor slabs.

#### 4.1.2 GENERAL SITE SUBGRADE PREPARATION

Remove existing below-grade structures, including utilities, in their entirety from within proposed building addition footprints. Reroute active utilities around the addition footprints. Backfill resulting depressions with granular engineered fill. In areas outside new building footprints (beneath pavements, the track, and adjacent to structures), cap the upper 18 inches of granular engineered fill with compacted clay. This will provide for a more uniform subgrade and will reduce the formation of “speed bumps” that may develop over time where standing water in contact with the higher plasticity clays causes heave over time.

Strip the site of surface materials and exercise caution to avoid over-stripping the site. Begin by removing (grubbing) only that portion of the topsoil containing root matter. Once grubbing is complete, SME will review the resulting subgrade, collect surface samples as necessary, and identify areas requiring additional topsoil removal. Base the decision to remove topsoil on organic content, rather than color. Remove only those near-surface soils with 4.0% or greater organic content.

Once the subgrade has been properly prepared as described above and remaining high areas have been cut, thoroughly compact the exposed subgrade prior to placing additional engineered fill. Adjacent to existing structures, compact the subgrade by dead rolling. Compact clay subgrade with sheepsfoot rollers and sand subgrade with steel drum rollers. Once the subgrade is compacted, evaluate the subgrade for suitability to support engineered fill by proofrolling with a rubber-tire tandem axle dump truck. If the areas are inaccessible to large equipment, observe and test the subgrade using hand-operated equipment such as hand auger probes, dynamic cone penetrometers, and nuclear density gauges.

Recompact or undercut and backfill areas of poor subgrade identified by SME with engineered fill to establish a uniform subgrade. Prior to placing aggregate/sand base, re-evaluate the resulting subgrade and address any remaining unstable areas identified by SME by improving in place or undercutting.

Perched groundwater should be expected during construction, and heavy accumulations into excavations from perched groundwater are possible if construction occurs during typically wetter periods of the year. Performing earthwork operations during the dryer summer months will reduce perched groundwater levels.

As with any construction site, the exposed subgrade (after site stripping) will be sensitive to disturbance under construction traffic, especially if the subgrade becomes wet. Therefore, limit heavy construction traffic to designated access routes and material laydown areas, and grade the exposed surface after stripping to allow surface drainage to occur. Include an allowance for pavement and sidewalk repair if construction traffic will use existing drives and parking areas.

The near-surface higher plasticity clays are difficult to moisture condition and are easily disturbed when wet and when trafficked. Depending upon schedule and the time of year of construction, chemical modification (lime and/or cement stabilization) may be required.

Stability under construction traffic will likely govern subgrade preparation beneath the proposed track. It may be necessary to place a thicker layer of crushed concrete/crushed aggregate beneath the track and/or place a separation fabric between the clay subgrade and the aggregate above.

### 4.1.3 ENGINEERED FILL REQUIREMENTS

Engineered fill placed within the construction area must be an approved material, free of frozen soil, organics, or other deleterious materials. Spread the fill in level layers and compact to a minimum of 95 percent of the maximum dry density as determined in accordance with the Modified Proctor test. Compact granular fill with a drum roller or vibratory plate type compactor and clay fill with a sheep's foot roller. To reduce the risk of subgrade disturbance, dead roll engineered fill where the lifts are within about 2.5 feet of perched water, and/or where relatively loose granular soils are located adjacent to existing structures and utilities that will remain active. Limit loose thickness to the maximum lift size the contractor's equipment can uniformly compact at one time. Place and compact clay at  $\pm 2$  percent of the optimum moisture content and allow wet sands to drain prior to reusing them as engineered fill. Thinner lifts may be required in confined spaces to achieve compaction of the backfill.

Engineered fill must meet the general requirements listed in the previous paragraph. If the proposed fill contains more than 4 percent organics or debris larger than 6 inches in nominal diameter, we recommend not using such soils for engineered fill.

Regarding the reuse of onsite clay soils as engineered fill at these sites, we recommend only reusing lean clay soils with a liquid limit of 40 or less, a plasticity index of 20 or less, and a maximum dry density of 120 pounds per cubic foot in proposed building areas. The lean-to-fat clays (CL/CH) will not meet these requirements, and therefore, those soils should not be considered for reuse as engineered fill within building footprints, as they are subject to volume changes with changes in moisture content. Their optimum moisture contents will also be much lower than their in-situ moisture contents, making them very difficult to properly place and compact and increasing the risk of heave over time even beyond the building footprints.

Use well-draining granular soils as engineered fill in areas where drainage is required or where compaction is achieved with hand-operated equipment. If the clean sands become mixed with the less desirable soils, they will no longer be suitable for reuse where MDOT Class II is recommended.

Where granular backfill is placed in trenches or adjacent to foundation walls, the upper 18 inches of engineered fill should consist of compacted low-plasticity (CL) clays or chemically modified CL/CH clays. The purpose of the "clay cap" is to reduce stormwater accumulations in granular trenches that can lead to premature pavement distress or can cause localized heave where water is in contact with shrink-swell susceptible clays.

### 4.1.4 SUBGRADE PREPARATION FOR FLOOR SLABS

If encountered, there is an elevated risk of poor slab performance associated with construction over undocumented fill, for which we presented subgrade preparation recommendations in Section 4.1.2 that will serve to reduce this risk. In addition to the recommended subgrade preparation, the risk of poor subgrade performance can be further reduced by placing a thicker than typical layer of dense-graded crushed aggregate or crushed concrete, such as MDOT 21AA, possibly in combination with a triaxial geogrid such as Tensar TX140.

Prior to concrete placement for floor slabs, observe and test the building pad subgrade for suitability of floor slab support by proofrolling. Where portions of the building are inaccessible with heavy equipment, evaluate the subgrade with hand-operated equipment such as nuclear density gauges, hand auger borings, and Dynamic Cone Penetrometer probes. The purpose of the re-evaluation is to identify any areas of subgrade disturbed during construction activities and verify subgrade conditions are suitable for floor slab support. Remediate any unsuitable areas identified during the subgrade evaluation.

We recommend the top four inches of the slab subbase consist of an approved granular material. The purpose of this is to provide a leveling surface for construction of the slab and a moisture capillary break between the slab and the underlying soils.

Either MDOT Class II sand or MDOT 21AA dense-graded aggregate or crushed concrete should be used. MDOT 21AA will provide a firmer subgrade if interior trades will be working above the subgrade prior to grade slab construction.

Compact the granular material or aggregate per the "Engineered Fill Requirements" section of this report. For slabs-on-grade constructed over dense-graded crushed aggregate or crushed concrete overlying suitably prepared existing fill, a vertical modulus of subgrade reaction of 125 pci may be used. Use a lower subgrade modulus of 110 pci for slabs placed over MDOT Class II sand.

We base these recommended subgrade moduli on empirical relationships between soil type and plate load tests performed with a 30-inch-diameter bearing plate and is the ratio of load in pounds per square-inch (psi) to a 0.05-inch deflection.

We recommend a vapor retarder below the floor slab if the slab is to receive an impermeable floor finish/seal or a floor covering which would act as a vapor barrier. The location of the vapor retarder (relative to the subbase) should be determined by the design Architect/Engineer based on the intended floor usage, planned finishes, and ACI recommendations.

Separate slabs from structural walls and columns bearing on their own foundations to permit relative movement. Provide construction joints at the interface between the new additions and existing structures, and do not span the joints with hard floor coverings. Protect subgrade soils from frost during winter construction. Remove or thaw any frozen soils prior to slab-on-grade construction.

*Even where CL/CH clays are not encountered near the ground surface, much of the near-surface clay is well above optimum moisture contents. Chemically stabilize the near-surface clays or otherwise verify the clays are properly moisture conditioned prior to placing slabs-on-grade. Overly desiccated clays (and floor slabs constructed above them) are at risk of heave over time as rehydration occurs, and overly wet clays are at risk of shrinkage (and slab settlement) over time.*

## 4.2 FOUNDATION RECOMMENDATIONS

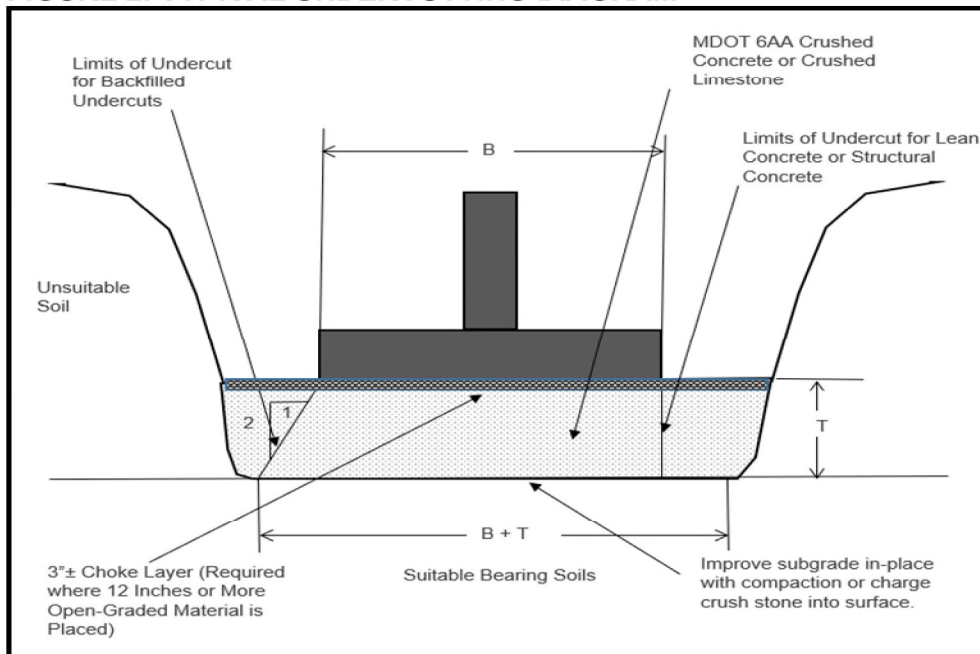
Support the concessions/team building and grandstands on shallow foundations (continuous strip foundations, isolated spread foundations, or Sonotube-type piers), bearing at minimum depths of 42 inches below final design site grades and bearing on suitably prepared native clays. Design shallow foundations bearing on stiff to very stiff clays for a net allowable bearing pressure of 3,000 psf. All shallow foundations are end-bearing only. We recommend a minimum pier diameter of 18 inches, a minimum continuous footing width of 16 inches, and 30 inches minimum dimension for spread foundations. In some cases, minimum foundation dimensions, rather than bearing pressure, will govern foundation sizes.

Once each footing area is exposed, evaluate the bearing subgrade using a proven method for clay subgrade. Housel penetrometers are not appropriate for these soils and their use will give misleading results. Furthermore, the test method must be capable of testing the soils several feet below the bearing level. There are several methods that can be used to evaluate foundations in the field should such conditions be encountered. The SME field representative will work with the SME Geotechnical Engineer of Record (GER) to determine appropriate exploratory methods during construction, should they be needed.

At isolated locations, unsuitable fill or unsuitably soft clays may be encountered. Depending upon in-field test results, we expect the subgrade can be addressed by conventional undercutting operations. For undercutting, use an open-graded crushed material with a maximum aggregate size of 1½ inches, with no more than seven percent passing the No. 200 sieve. MDOT 6AA meets this requirement. To reduce the risk of differential settlement associated with migration of sands into the void spaces and cyclical movement associated with changes in moisture of the clays below the foundations, where 12 inches or more open-graded stabilization material is placed, "choke" the surface with a thin layer of dense-graded crushed aggregate or crushed concrete, such as MDOT 21AA.

Where required, extend undercuts laterally on a two vertical to one horizontal slope from the edge of the foundation. Refer to the following Typical Foundation Undercutting Diagram:

**FIGURE 2: TYPICAL UNDERCUTTING DIAGRAM**



Remove any caved soils from the foundation bearing surfaces before placing concrete. The subgrade soils are susceptible to disturbance, especially when exposed to water and trafficked. Remove disturbed soils immediately prior to foundation concrete placement. Place a working surface of either crushed aggregate or crushed concrete in areas where groundwater accumulates to protect the exposed surface from disturbance.

The contractor must maintain vertical excavation sidewalls to prevent the foundation excavations from “mushrooming out” at the top and creating frost lips. Where vertical excavations cannot be maintained, over-excavate and form foundations, rather than construct foundations using “neat trench” methods. The existing clays are generally conducive to bank-formed foundations; however, where granular soils are encountered, and vertical excavation sidewalls cannot be maintained, foundations may need to be over-excavated and formed.

We estimate total settlements for shallow foundations to be about one inch or less. Differential settlements for foundations constructed on native clays and supporting similar loads are estimated to be about one-half of the total settlement, or less. We base these settlement estimates on the boring information, the maximum net allowable soil bearing pressure provided, the referenced design structural loads, our experience with similar structures and soil conditions, and field verification of suitable bearing soils by SME.

As the depth of fill may vary across the site, include a contingency for foundation undercuts. We recommend bid form units of “cubic yards – in-place”, as undercuts can be directly measured in the field at the time of construction and are not subject to arbitrary “fluff factors” associated with other methods of measurement.

### 4.3 SYNTHETIC TURF RECOMMENDATIONS

We encountered eight to 24 inches of topsoil over native clays. The shear strengths and moisture contents indicate that the native clays may be sensitive to volume changes with changes in moisture content. USACE DCP tests were performed at each hand auger probe location. The results of the USACE DCP tests are included in Appendix A.

Table 1 summarizes our opinion of the typical support conditions of the subgrade based on ranges of estimated in-situ CBR values. Table 2 summarizes the support very poor to poor subgrade support conditions.

**TABLE 1: SUBGRADE SUPPORT CONDITIONS**

SUPPORT CONDITIONS	CBR RANGE FOR AGGREGATE BASE MATERIAL (%)	CBR RANGE FOR SUBGRADE SOILS (%)
Good	>80	>10
Marginal	60 to 80	5 to 10
Poor	30 to 60	3 to 5
Very Poor	<30	<3

**TABLE 2: VERY POOR TO POOR SUBGRADE SUPPORT CONDITIONS**

BORING NO.	DEPTH FROM SURFACE (IN)		CONDITION
	FROM	TO	
HA-1	0	30.1	Poor/Very Poor
HA-2	0	32.9	Poor/Very Poor
HA-3	0	34.3	Very Poor
HA-4	0	25.4	Poor/Very Poor
HA-5	10.8	26.4	Poor/Very Poor
HA-6	0	33.9	Very Poor
HA-7	0	35.6	Very Poor
HA-8	0	34.3	Very Poor
HA-9	0	36.2	Very Poor
HA-10	0	35.6	Very Poor

The existing natural turf, multi-use athletic field will be replaced with a new synthetic turf system. Install the synthetic turf (including bedding and drainage systems) per the manufacturer's specifications and recommendations. If the manufacturer's recommendations contradict the recommendations we provide herein, contact us for clarification. We anticipate cuts and/or fills about one to two feet to allow for the installation of the drainage system and aggregate base.

Earthwork operations will consist of stripping the near-surface surficial topsoil and vegetation. We anticipate the existing surface topsoil will be removed to establish the field section. Stripping operations should be observed by SME. **Removal of the surface topsoil by the contractor should not be based on color alone.** Staining of the underlying soils directly below the topsoil layer is common, and removal of all dark-colored fill can potentially lead to over-stripping. Unless the field designer or owner are especially sensitive to settlement, we do not anticipate it will be necessary to undercut all fill or fill containing topsoil.

Topsoil removal should be based upon the organic content of the soil. Expect variable topsoil thickness across the field and provide for an allowance in project documents to account for potential undercuts. In general, most traffic and field damage occurs near the center of the field. In general, soils containing more the four percent organics should be stripped from the field areas. A determination of the organic content of the soil can be made at the time of construction depending on the final site grading plan; however, unless strict subgrade conditions and low tolerance to differential settlement are required, we expect existing fill (including that containing some topsoil content) can remain in place, provided it can be adequately improved and can pass a final proofroll.

Once the site is properly stripped, we anticipate the exposed subgrade will generally consist of undocumented fill overlying native clays soils. Once surface topsoil is removed, slope the resulting subgrade to provide drainage to under field and/or perimeter drains, then uniformly compact the field subgrade.

Once a uniform clay grade has been established, prepare and proofroll the subgrade as described in Section 4.1.2.

#### 4.4 SEISMIC SITE CLASS

The known shear strength and N-values for drift at the project sites are limited to the explored depths of about 15 feet below the ground surface at borings drilled for this evaluation. Based on the referenced soil conditions, and our experience at nearby sites, seismic site Class D applies to these sites in accordance with the 2015 Michigan Building Code (MBC) referencing Table 20.3-1 in ASCE Standard ASCE/SEI 7-16.

Based on the addresses of the sites, the mapped short-period spectral response acceleration,  $S_s$ , and mapped spectral response acceleration at 1-second period,  $S_{D1}$ , is 0.103g (less than or equal to 0.15g) and 0.046g (greater than 0.04g), respectively. Based on the mapped accelerations, the calculated short-period spectral response acceleration  $S_{DS}$ , and calculated spectral response acceleration at 1-second period,  $S_{D1}$ , is 0.11g (less than 0.167g) and 0.074g (greater than 0.067g), respectively. As the spectral response acceleration data exceeds the maximum criteria for Seismic Design Category A, a Seismic Design Category B applies.

#### 4.5 CONSTRUCTION CONSIDERATIONS

Conventional groundwater control methods (e.g. sump pits and pumps) should be adequate to control the perched groundwater seepages on a local basis. Multiple sumps and pits may be necessary for dewatering excavations that extend greater than about one to two feet below the groundwater table. In some cases, even after dewatering, the exposed subgrade can remain wet and sensitive to disturbance. Sensitive subgrade (where encountered) will need to be protected from disturbance. This is typically accomplished with undercutting and backfilling with crushed stone/aggregate materials and possibly the use of a geotextile separator fabric, although chemical modification is also a consideration for some of the sites. Construction traffic will likely travel over existing sidewalks and pavements. Include a contingency for sidewalk and pavement repair or replacement in the project budgets.

The contractor must protect existing structures and utilities to remain in place during construction. Do not extend temporary excavations below the bottom of existing adjacent improvements (e.g., foundations, utilities, etc.) without bracing, shoring or underpinning of the existing improvement. Exercise care during the excavating and compacting operations so that excessive vibrations do not cause settlement of existing structures and pavements, or utilities are not damaged or undermined.

Based on MIOSHA-STD-1306 (3/18/13) Part 9. Excavation, Trenching, and Shoring, the maximum angle of repose for excavations deeper than five feet (unsupported) for the soil and groundwater conditions encountered at the site are as follows:

SOIL TYPE	ANGLE OF REPOSE <sup>1</sup>
Natural Sands Above Groundwater Table	1H:1V (45 °)
Natural Sands Below Groundwater Table	2H:1V (26 °)
Engineered Sand Fill	1H:1V (45 °)
Stiff Clay (minimum of 2.5 tsf <sup>2</sup> )	1/2H:1V (63°)
Firm Clay (minimum of 1.5 tsf <sup>2</sup> )	2/3H:1V (56 °)

- NOTES:** 1. Conditions encountered during construction may require flatter slopes and/or a flat working space at the top of the slope. Also, flatter slopes would be required in clay with sand seams or partings that could potentially develop slide planes. As with any temporary slopes, weather conditions and surface runoff can adversely affect the slope condition.  
2. Strength values are unconfirmed compressive strength based on a hand penetrometer.

Utilities backfilled with clays, clayey and silty sands, and topsoil are more susceptible to corrosion than are clean sands, bed and backfill utilities in granular engineered fill and separate utilities of differing materials.

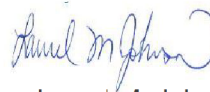
## 5. SIGNATURES

Report Prepared By:

 Bryan Bernard  
May 19 2022 3:27 PM

Kyle P. Areaux, PE  
Senior Staff Engineer

Report Reviewed By:

 Laurel Johnson  
May 19 2022 2:05 PM

Laurel M. Johnson, PE  
Senior Consultant



## **APPENDIX A**

**BORING LOCATION PLANS (FIGS. 1 THROUGH 4)**

**BORING LOG TERMINOLOGY**

**BORING LOGS (B1 THROUGH B9 & HA-1 THROUGH HA-10)**

**USACE DCP DATA SHEETS (HA-1 THROUGH HA-10)**



Figure No. 1

**BORING LOCATION PLAN - OVERVIEW**  
**CRESTWOOD HIGH SCHOOL ATHLETIC FIELD**  
**1501 NORTH BEECH DALY ROAD**  
**DEARBORN HEIGHTS, MICHIGAN**

No.	Revision Date	Date	May 02, 2022
	Drawn By	Drawn By	KPA
	Designed By	Designed By	KPA
	Scale	Scale	NTS
	Project	Project	88984.00



NOTE:  
BORING LOCATIONS ARE SHOWN AS APPROXIMATE. DRAWING  
INFORMATION REFERENCED FROM GOOGLE EARTH AERIAL  
IMAGERY DATED MARCH 19, 2021. NOT TO SCALE.

APPROXIMATE BORING LOCATIONS

APPROXIMATE HAND AUGER LOCATIONS

No.	Revision Date	Date	May 02, 2022
	Drawn By	KPA	
	Designed By	KPA	
	Scale	NTS	
	Project	88984.00	

**BORING LOCATION PLAN**  
**CRESTWOOD HIGH SCHOOL ATHLETIC FIELD**  
**1501 NORTH BEECH DALY ROAD**  
**DEARBORN HEIGHTS, MICHIGAN**



Figure No. 2



NOTE:  
BORING LOCATIONS ARE SHOWN AS APPROXIMATE. DRAWING  
INFORMATION REFERENCED FROM GOOGLE EARTH AERIAL  
IMAGERY DATED MARCH 19, 2021. NOT TO SCALE.

-  APPROXIMATE BORING LOCATIONS
-  APPROXIMATE HAND AUGER LOCATIONS


No.	Revision Date	Date	May 02, 2022
	Drawn By	KPA	
	Designed By	KPA	
	Scale	NTS	
	Project	88984.00	

**BORING LOCATION PLAN**  
**CRESTWOOD HIGH SCHOOL ATHLETIC FIELD**  
**1501 NORTH BEECH DALY ROAD**  
**DEARBORN HEIGHTS, MICHIGAN**





NOTE:  
BORING LOCATIONS ARE SHOWN AS APPROXIMATE. DRAWING  
INFORMATION REFERENCED FROM GOOGLE EARTH AERIAL  
IMAGERY DATED MARCH 19, 2021. NOT TO SCALE.

 APPROXIMATE BORING LOCATIONS
















 APPROXIMATE HAND AUGER LOCATIONS













No.	Revision Date	Date	May 02, 2022
	Drawn By	KPA	
	Designed By	KPA	
	Scale	NTS	
	Project	88984.00	

**BORING LOCATION PLAN**  
**CRESTWOOD HIGH SCHOOL ATHLETIC FIELD**  
**1501 NORTH BEECH DALY ROAD**  
**DEARBORN HEIGHTS, MICHIGAN**



**Figure No. 4**

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		
<b>COARSE-GRAINED SOIL</b> (more than 50% of material is larger than No. 200 sieve size.)		
Clean Gravel (Less than 5% fines)		
<b>GRAVEL</b> More than 50% of coarse fraction larger than No. 4 sieve size		GW Well-graded gravel; gravel-sand mixtures, little or no fines
		GP Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	
		GM Silty gravel; gravel-sand-silt mixtures
		GC Clayey gravel; gravel-sand-clay mixtures
Clean Sand (Less than 5% fines)		
<b>SAND</b> 50% or more of coarse fraction smaller than No. 4 sieve size		SW Well-graded sand; sand-gravel mixtures, little or no fines
		SP Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	
		SM Silty sand; sand-silt-gravel mixtures
		SC Clayey sand; sand-clay-gravel mixtures
<b>FINE-GRAINED SOIL</b> (50% or more of material is smaller than No. 200 sieve size)		
<b>SILT AND CLAY</b> Liquid limit less than 50%		ML Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL Organic silt and organic clay of low plasticity
<b>SILT AND CLAY</b> Liquid limit 50% or greater		MH Inorganic silt of high plasticity, elastic silt
		CH Inorganic clay of high plasticity, fat clay
		OH Organic silt and organic clay of high plasticity
<b>HIGHLY ORGANIC SOIL</b>		PT Peat and other highly organic soil

OTHER MATERIAL SYMBOLS		
		
		
		
		

LABORATORY CLASSIFICATION CRITERIA	
GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3
GP	Not meeting all gradation requirements for GW
GM	Atterberg limits below "A" line or PI less than 4
GC	Atterberg limits above "A" line with PI greater than 7
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3
SP	Not meeting all gradation requirements for SW
SM	Atterberg limits below "A" line or PI less than 4
SC	Atterberg limits above "A" line with PI greater than 7

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:

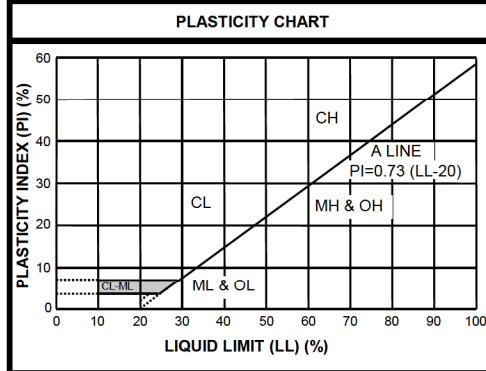
Less than 5 percent.....GW, GP, SW, SP  
 More than 12 percent.....GM, GC, SM, SC  
 5 to 12 percent.....Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)

PARTICLE SIZES	
Boulders	- Greater than 12 inches
Cobbles	- 3 inches to 12 inches
Gravel- Coarse	- 3/4 inches to 3 inches
Fine	- No. 4 to 3/4 inches
Sand- Coarse	- No. 10 to No. 4
Medium	- No. 40 to No. 10
Fine	- No. 200 to No. 40
Silt and Clay	- Less than (0.074 mm)



VISUAL MANUAL PROCEDURE
When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:
For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:
<ul style="list-style-type: none"> <li>• SC/CL (CLAYEY SAND to Sandy LEAN CLAY)</li> <li>• SM/ML (SILTY SAND to SANDY SILT)</li> <li>• GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)</li> <li>• GM/ML (SILTY GRAVEL to Gravelly SILT)</li> </ul>
For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:
<ul style="list-style-type: none"> <li>• SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)</li> <li>• SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)</li> <li>• SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)</li> <li>• SW/SP (SAND or SAND with Gravel)</li> <li>• GP/GW (GRAVEL or GRAVEL with Sand)</li> <li>• SC/SM (CLAYEY to SILTY SAND)</li> <li>• GM/GC (SILTY to CLAYEY GRAVEL)</li> <li>• CL/ML (SILTY CLAY)</li> <li>• ML/CL (CLAYEY SILT)</li> <li>• CH/MH (FAT CLAY to ELASTIC SILT)</li> <li>• CL/CH (LEAN to FAT CLAY)</li> <li>• MH/ML (ELASTIC SILT to SILT)</li> </ul>

DRILLING AND SAMPLING ABBREVIATIONS	
2ST	- Shelby Tube - 2" O.D.
3ST	- Shelby Tube - 3" O.D.
AS	- Auger Sample
GS	- Grab Sample
LS	- Liner Sample
NR	- No Recovery
PM	- Pressuremeter
RC	- Rock Core diamond bit. NX size, except where noted
SB	- Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	- Vane Shear
WS	- Wash Sample

OTHER ABBREVIATIONS	
WOH	- Weight of Hammer
WOR	- Weight of Rods
SP	- Soil Probe
PID	- Photo Ionization Device
FID	- Flame Ionization Device

DEPOSITIONAL FEATURES	
Parting	- as much as 1/16 inch thick
Seam	- 1/16 inch to 1/2 inch thick
Layer	- 1/2 inch to 12 inches thick
Stratum	- greater than 12 inches thick
Pocket	- deposit of limited lateral extent
Lens	- lenticular deposit
Hardpan/Till	- an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	- soil deposited by lake water
Mottled	- soil irregularly marked with spots of different colors that vary in number and size
Varved	- alternating partings or seams of silt and/or clay
Occasional	- one or less per foot of thickness
Frequent	- more than one per foot of thickness
Interbedded	- strata of soil or beds of rock lying between or alternating with other strata of a different nature

DESCRIPTION OF RELATIVE QUANTITIES	
The visual-manual procedure uses the following terms to describe the relative quantities of notable foreign materials, gravel, sand or fines:	
Trace	- particles are present but estimated to be less than 5%
Few	- 5 to 10%
Little	- 15 to 25%
Some	- 30 to 45%
Mostly	- 50 to 100%

CLASSIFICATION TERMINOLOGY AND CORRELATIONS			
<b>Cohesionless Soils</b>		<b>Cohesive Soils</b>	
<b>Relative Density</b>	<b>N<sub>60</sub> (N-Value) (Blows per foot)</b>	<b>Consistency</b>	<b>N<sub>60</sub> (N-Value) (Blows per foot)</b>
Very Loose	0 to 4	Very Soft	< 2
Loose	5 to 10	Soft	2 - 4
Medium Dense	11 to 30	Medium	5 - 8
Dense	31 to 50	Stiff	9 - 15
Very Dense	51 to 80	Very Stiff	16 - 30
Extremely Dense	Over 81	Hard	> 30
		<b>Undrained Shear Strength (kips/ft<sup>2</sup>)</b>	
		< 0.25 or less	
		> 0.25 to 0.50	
		> 0.50 to 1.0	
		> 1.0 to 2.0	
		> 2.0 to 4.0	
		> 4.0 or greater	

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted. N<sub>60</sub> values as reported on boring logs represent raw N-values corrected for hammer efficiency only.

5/19/22 1:50:21 PM



# BORING B 1

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/4/22

**COMPLETED:** 5/4/22

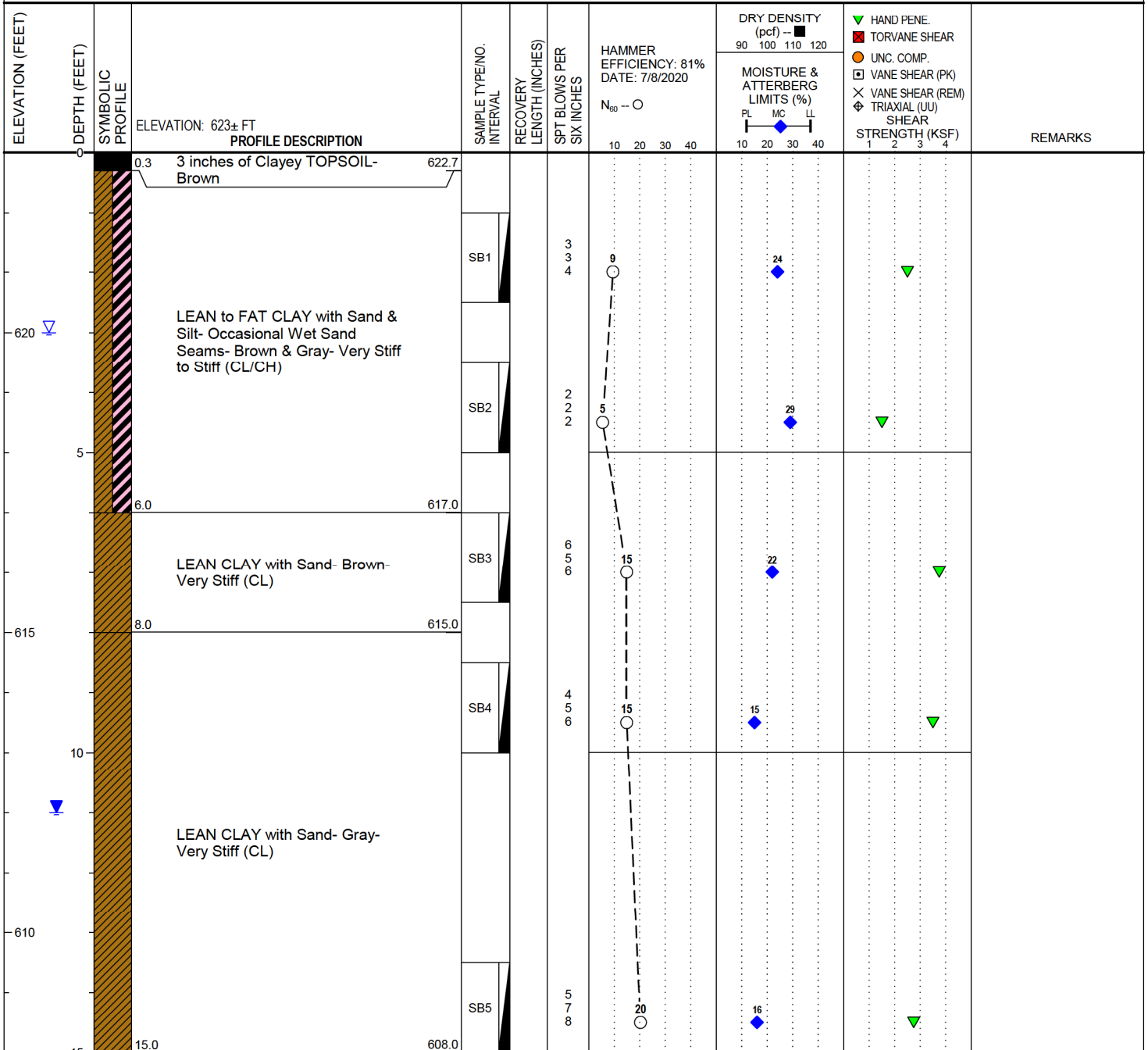
**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ



GROUNDWATER & BACKFILL INFORMATION		
	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	3.0	620.0
▽ AT END OF BORING:	11.0	612.0
<b>BACKFILL METHOD:</b> Auger Cuttings		

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

5/19/22 1:50:22 PM



# BORING B 2

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/6/22

**COMPLETED:** 5/6/22

**BORING METHOD:** Hand Auger

**DRILLER:** KPA

**RIG NO.:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	HAMMER EFFICIENCY: 81% DATE: 7/8/2020 N <sub>60</sub> -- O	DRY DENSITY (pcf) -- ■				MOISTURE & ATTERBERG LIMITS (%)				STRENGTH (KSF)	REMARKS
							90	100	110	120	PL	MC	LL	1		
623	0		6 inches of CLAYEY TOPSOIL- Dark Brown													
622.5	0.5															
620			LEAN to FAT CLAY with Sand- Brown & Gray- Very Stiff to Stiff (CL/CH)	AS1										30		
615	5			AS2										25		
616	7.0		LEAN CLAY- Trace Sand- Brown- Very Stiff (CL)	AS3										23		
615				AS4										19		
610	10.5		LEAN CLAY with Sand- Trace Gravel- Gray- Very Stiff (CL)	AS5										23		
610				AS6										15		
608.0	15.0		END OF BORING AT 15.0 FEET.													

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>		<b>NOTES:</b> 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual. 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered. 3. Boring was not accessible by the truck mounted drill rig. Therefore, hand auger probes were manually advanced and N-Values are unavailable.
GROUNDWATER WAS NOT ENCOUNTERED		
<b>BACKFILL METHOD:</b> Auger Cuttings		



5/19/22 1:50:23 PM



# BORING B 3

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/6/22

**COMPLETED:** 5/6/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 622± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	HAMMER EFFICIENCY: 81% DATE: 7/8/2020 N <sub>60</sub> -- O	DRY DENSITY (pcf) -- ■		MOISTURE & ATTERBERG LIMITS (%)	▼ HAND PENE. ■ TORVANE SHEAR ○ UNC. COMP. □ VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF) 1 2 3 4	REMARKS
							90	100 110 120			
0	0		14 inches of CLAYEY TOPSOIL- Dark Brown								
	1.2		620.8								
620			LEAN to FAT CLAY with Sand- Brown & Gray- Very Stiff (CL)	SB1				25			
	5.0		617.0	SB2				28			
615			LEAN CLAY- Trace Sand- Brown- Very Stiff (CL/CH)	SB3				25			
				SB4				21			
610			LEAN CLAY with Sand - Trace Gravel- Gray- Very Stiff (CL)	SB5				18			
	11.0		611.0								
	15.0		607.0	SB6				19			

END OF BORING AT 15.0 FEET.

**GROUNDWATER & BACKFILL INFORMATION**

GROUNDWATER WAS NOT ENCOUNTERED

**BACKFILL METHOD:** Auger Cuttings

- NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. Boring was not accessible by the truck mounted drill rig. Therefore, hand auger probes were manually advanced and N-Values are unavailable.

5/19/22 1:50:24 PM



# BORING B 4

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/4/22

**COMPLETED:** 5/4/22

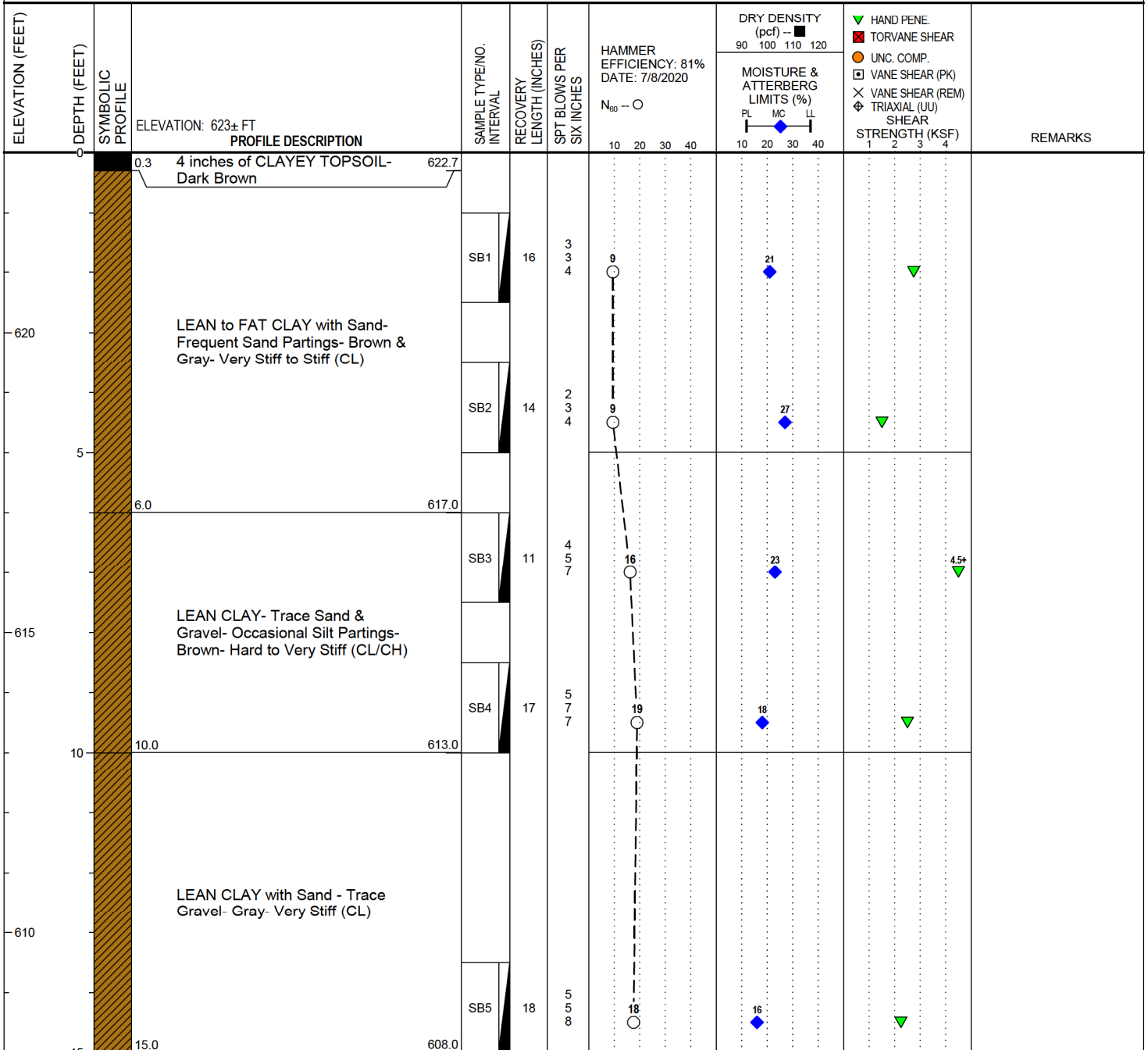
**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ



<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>	<p>NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.</p> <p>2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.</p>
GROUNDWATER WAS NOT ENCOUNTERED	
<b>BACKFILL METHOD:</b> Auger Cuttings	

5/19/22 1:50:25 PM



# BORING B 5

PAGE 1 OF 1

BORING DEPTH: 15 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/4/22

**COMPLETED:** 5/4/22

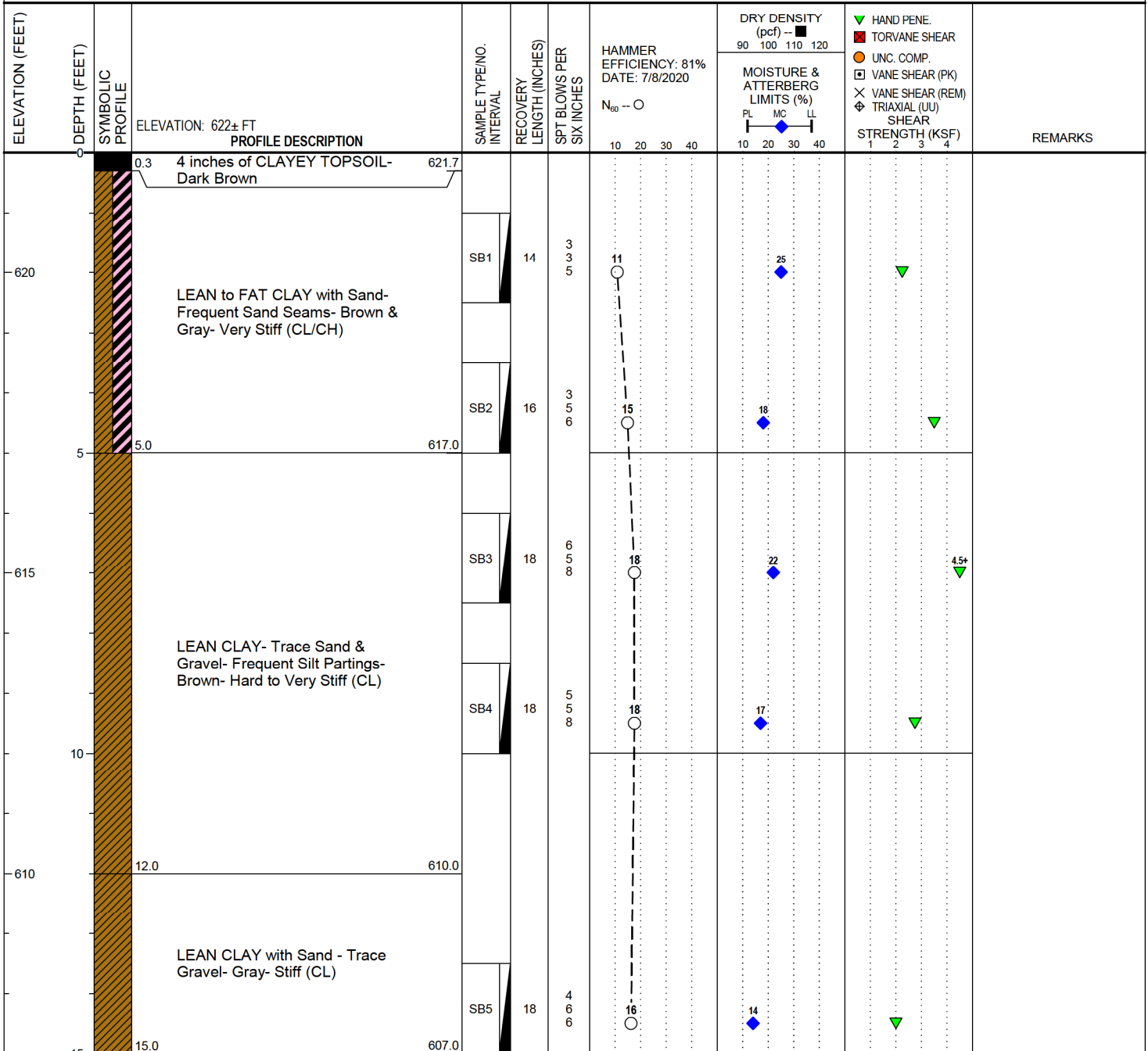
**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ



<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>	<p>NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.</p> <p>2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.</p>
GROUNDWATER WAS NOT ENCOUNTERED	
<b>BACKFILL METHOD:</b> Auger Cuttings	

5/19/22 1:50:27 PM



# BORING B 6

PAGE 1 OF 1

BORING DEPTH: 10 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/4/22

**COMPLETED:** 5/4/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 624± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 81% DATE: 7/8/2020 N <sub>60</sub> -- ○	DRY DENSITY (pcf) -- ■			MOISTURE & ATTERBERG LIMITS (%)				REMARKS
								90	100	110	120	PL	MC	LL	
	0.3		4 inches of CLAYEY TOPSOIL- Dark Brown												
	3.0		FILL- LEAN to FAT CLAY with Sand- Occasional Sand Seams- Brown & Gray- Stiff (CL)	SB1	16	3 4 4	11			25					
620	5.0		LEAN CLAY- Trace Sand- Brown- Very Stiff (CL)	SB2	14	2 3 3	8			25					
	8.0		LEAN CLAY with Sand- Gray- Very Stiff (CL)	SB3	18	2 3 5	11			20					
615	10.0		END OF BORING AT 10.0 FEET.	SB4	16	5 5 6	15			18					

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

5/19/22 1:50:28 PM



# BORING B 7

PAGE 1 OF 1

BORING DEPTH: 10 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/4/22

**COMPLETED:** 5/4/22

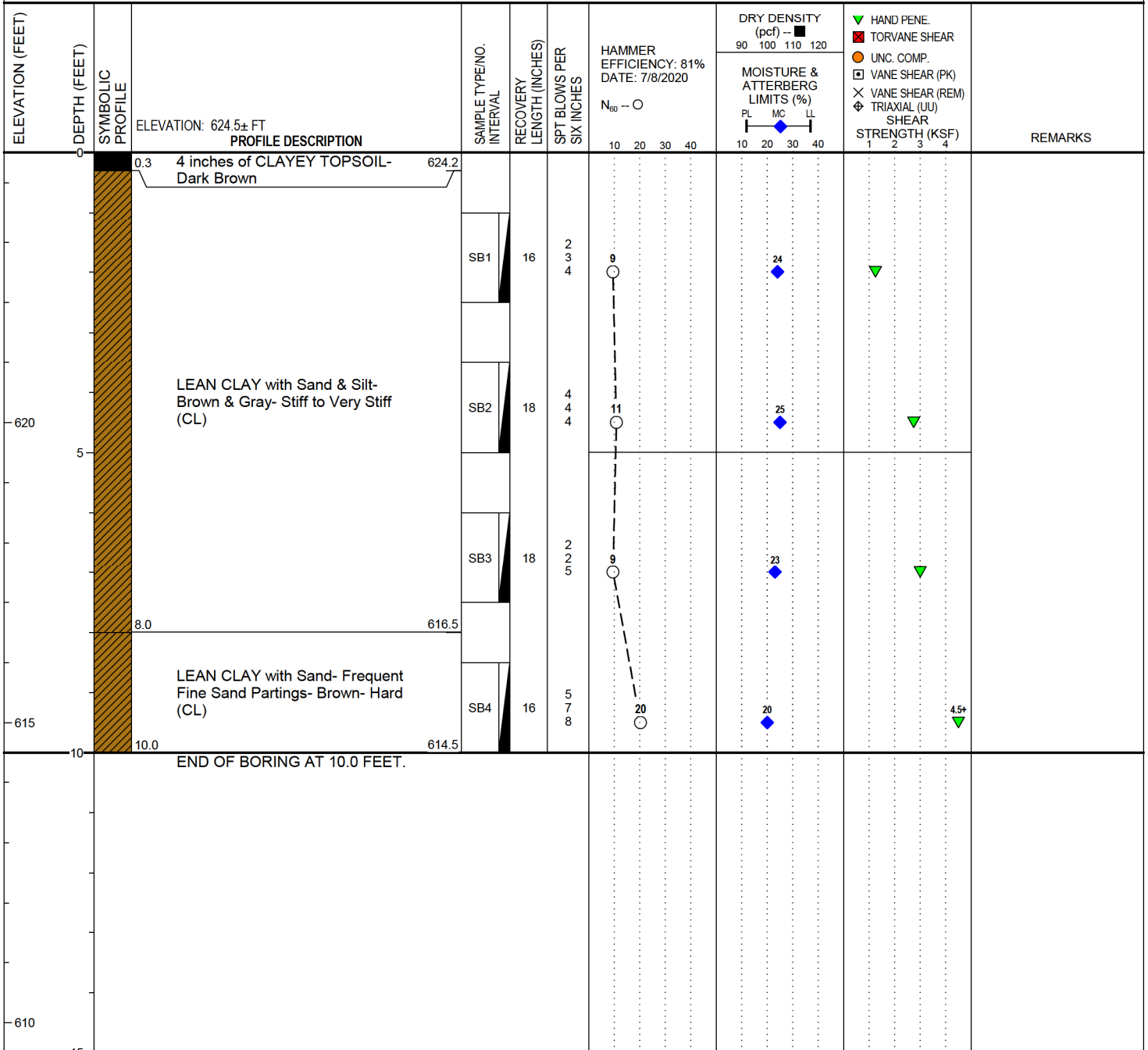
**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ



**GROUNDWATER & BACKFILL INFORMATION**

GROUNDWATER WAS NOT ENCOUNTERED

**BACKFILL METHOD:** Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

5/19/22 1:50:29 PM



# BORING B 8

PAGE 1 OF 1

BORING DEPTH: 10 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/4/22

**COMPLETED:** 5/4/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 622.5± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 81% DATE: 7/8/2020 N <sub>60</sub> -- ○	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%) PL MC LL	<ul style="list-style-type: none"> <li>▼ HAND PENE.</li> <li>■ TORVANE SHEAR</li> <li>○ UNC. COMP.</li> <li>□ VANE SHEAR (PK)</li> <li>× VANE SHEAR (REM)</li> <li>◇ TRIAXIAL (UU) SHEAR</li> <li>STRENGTH (KSF)</li> </ul>	REMARKS
								90 100 110 120			
	0.3		4 inches of HOT MIX ASPHALT								
	0.8		6 inches of Gravelly Sand-Brown- Moist (SP)								
620			LEAN CLAY with Sand- Stiff to Very Stiff (CL)	SB1	16	2 3 4	9		25		
				SB2	18	2 2 5	9		23		
615				SB3	18	4 6 7	18		21		
	8.0		LEAN to FAT CLAY with Sand- Gray- Very Stiff (CL/CH)								
610				SB4	16	5 6 5	15		35		
	10.0		END OF BORING AT 10.0 FEET.								

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

5/19/22 1:50:30 PM



# BORING B 9

PAGE 1 OF 1

BORING DEPTH: 10 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/4/22

**COMPLETED:** 5/4/22

**BORING METHOD:** Solid-stem Augers

**DRILLER:** JR/WN/AC

**RIG NO.:** 281 (CME 45B)

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	HAMMER EFFICIENCY: 81% DATE: 7/8/2020 N <sub>60</sub> -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%) PL MC LL	STRENGTH (KSF) 1 2 3 4	REMARKS
								90 100 110 120			
	0.3		4 inches of HOT MIX ASPHALT								
	0.8		5 inches of Gravelly Sand-Brown- Moist (SP)								
620			LEAN to FAT CLAY with Sand & Silt- Frequent Sand Partings- Occasional Wet Sand Partings- Brown & Gray- Very Stiff (CL/CH)	SB1	3 4 4		11	10			
				SB2	3 5 5		14	26			
615			LEAN CLAY with Sand- Brown- Stiff (CL)	SB3	4 3 4		9	26			
				SB4	8 11 15		35	16			
610	10.0		END OF BORING AT 10.0 FEET.								

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>	<p>NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.</p> <p>2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.</p>
GROUNDWATER WAS NOT ENCOUNTERED	
<b>BACKFILL METHOD:</b> Auger Cuttings	

5/19/22 1:50:31 PM



# BORING HA-1

PAGE 1 OF 1

BORING DEPTH: 5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	STRENGTH (KSF)	REMARKS
							90 100 110 120			
623	0		12 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
620	1.0		LEAN to FAT CLAY with Sand- Frequent Sand Seams- Brown & Gray- Very Stiff (CL/CH)							
618	5.0		END OF BORING AT 5.0 FEET.	AS2			28			
615										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.



5/19/22 1:50:32 PM



# BORING HA-10

PAGE 1 OF 1

BORING DEPTH: 4.5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	<input type="checkbox"/> HAND PENE. <input type="checkbox"/> TORVANE SHEAR <input type="checkbox"/> UNC. COMP. <input type="checkbox"/> VANE SHEAR (PK) <input type="checkbox"/> VANE SHEAR (REM) <input type="checkbox"/> TRIAXIAL (UU) <input type="checkbox"/> SHEAR STRENGTH (KSF)	REMARKS
							90 100 110 120			
623	0									
	1.3		16 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
620			LEAN to FAT CLAY with Sand- Occasional Clayey Sand Seams- Brown & Gray- Very Stiff (CL/CH)	AS2						
	4.5		END OF BORING AT 4.5 FEET.							
5										
615										
10										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.

5/19/22 1:50:33 PM



# BORING HA-2

PAGE 1 OF 1

BORING DEPTH: 5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	▼ HAND PENE. ■ TORVANE SHEAR ● UNC. COMP. □ VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF) 1 2 3 4	REMARKS
							90 100 110 120			
	0		8 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
	0.7									
	620		LEAN to FAT CLAY with Sand- Frequent Clayey Sand Seams- Brown & Gray- Very Stiff (CL/CH)							
	5		END OF BORING AT 5.0 FEET.	AS2				28		
	5.0									
	615									
	10									
	610									
	15									

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.

5/19/22 1:50:34 PM



# BORING HA-3

PAGE 1 OF 1

BORING DEPTH: 5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	<input type="checkbox"/> HAND PENE. <input type="checkbox"/> TORVANE SHEAR <input type="checkbox"/> UNC. COMP. <input type="checkbox"/> VANE SHEAR (PK) <input type="checkbox"/> VANE SHEAR (REM) <input type="checkbox"/> TRIAXIAL (UU) SHEAR STRENGTH (KSF)	REMARKS
							90 100 110 120			
0	0									
	1.0		12 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
620			LEAN to FAT CLAY with Sand- Frequent Sand Seams- Brown & Gray- Very Stiff (CL/CH)							
	5.0		END OF BORING AT 5.0 FEET.	AS2			24			
615										
10										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.

5/19/22 1:50:34 PM



# BORING HA-4

PAGE 1 OF 1

BORING DEPTH: 4.5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	▼ HAND PENE. ■ TORVANE SHEAR ○ UNC. COMP. □ VANE SHEAR (PK) × VANE SHEAR (REM) ◆ TRIAXIAL (UU) SHEAR STRENGTH (KSF)	REMARKS
							90 100 110 120			
	0									
	1.0		12 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
620			LEAN to FAT CLAY with Sand-Frequent Sand Seams- Brown & Gray- Stiff (CL/CH)							
	4.5		END OF BORING AT 4.5 FEET.	AS2				26		
5										
615										
10										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.



5/19/22 1:50:36 PM



# BORING HA-6

PAGE 1 OF 1

BORING DEPTH: 4.5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	STRENGTH (KSF)	REMARKS
							90 100 110 120			
623	0		18 inches of CLAYEY TOPSOIL- Trace Root Fibers- Dark Brown	AS1						
620	1.5		LEAN to FAT CLAY with Sand- Brown & Gray- Very Stiff (CL/CH)	AS2			22			
618.5	4.5		END OF BORING AT 4.5 FEET.							
615										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.

5/19/22 1:50:37 PM



# BORING HA-7

PAGE 1 OF 1

BORING DEPTH: 5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	STRENGTH (KSF)	REMARKS
							90 100 110 120			
0	0									
	2.0		24 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
620			LEAN to FAT CLAY with Sand- Frequent Sand Seams- Brown & Gray- Very Stiff (CL/CH)							
	5.0		END OF BORING AT 5.0 FEET.	AS2			22			
615										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.

5/19/22 1:50:38 PM



# BORING HA-8

PAGE 1 OF 1

BORING DEPTH: 5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	STRENGTH (KSF)	REMARKS
							90 100 110 120			
0	0		18 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
620	1.5		LEAN to FAT CLAY with Sand- Frequent Sand Seams- Brown & Gray- Stiff (CL/CH)							
618.0	5.0		END OF BORING AT 5.0 FEET.	AS2			24			
615										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.



5/19/22 1:50:39 PM



# BORING HA-9

PAGE 1 OF 1

BORING DEPTH: 5 FEET

**PROJECT NAME:** Crestwood High School Athletic Field

**PROJECT NUMBER:** 088984.00

**CLIENT:** Ehresman Architects

**PROJECT LOCATION:** Dearborn Heights, Michigan

**DATE STARTED:** 5/5/22

**COMPLETED:** 5/5/22

**BORING METHOD:** Hand Auger

**FIELD REPRESENTATIVE:** KPA

**EQUIPMENT:** Hand Auger

**LOGGED BY:** KPA

**CHECKED BY:** LMJ

ELEVATION (FEET)	DEPTH (FEET)	SYMBOLIC PROFILE	ELEVATION: 623± FT PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	BLOWS PER SIX INCHES	DYNAMIC CONE PENETROMETER (DCP) -- O	DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	STRENGTH (KSF)	REMARKS
							90 100 110 120			
0	0									
	1.5		18 inches of CLAYEY TOPSOIL- Dark Brown	AS1						
620			LEAN to FAT CLAY with Sand- Frequent Sand Seams- Brown & Gray- Stiff (CL/CH)							
	5.0		END OF BORING AT 5.0 FEET.	AS2			24			
615										
610										
15										

<b>GROUNDWATER &amp; BACKFILL INFORMATION</b>
GROUNDWATER WAS NOT ENCOUNTERED
<b>BACKFILL METHOD:</b> Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.  
 2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.  
 3. USACE Dynamic Cone Penetrometer (DCP) test data is summarized on the USACE DCP data sheets.



**USACE DCP DATA SHEET**

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA

PROBE/CORE: HA-1  
 LOCATION: \_\_\_\_\_  
 LANE: \_\_\_\_\_  
 STATION: \_\_\_\_\_  
 OFFSET: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 GROUND EL: \_\_\_\_\_

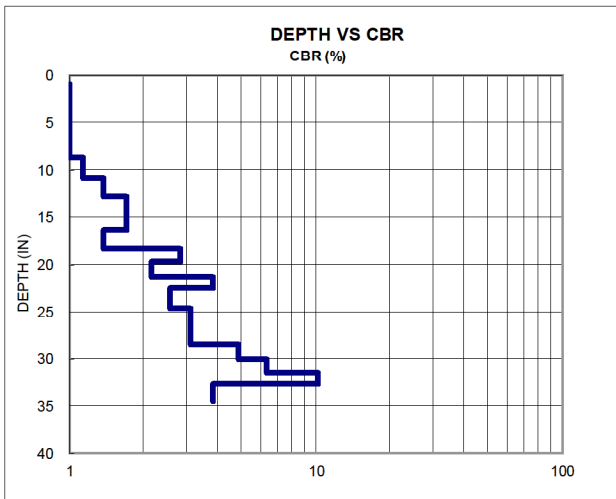
DEPTH TO START OF TEST FROM SURFACE: 1 inches

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	130	0						
1	210	80	80	2	0.1	4.1	Very Poor	
1	255	45	45	2	0.4	5.9	Very Poor	
2	325	70	35	2	0.7	8.7	Very Poor	
2	380	55	28	2	1.1	10.8	Very Poor	
2	430	50	25	2	1.4	12.8	Very Poor	0.7
2	475	45	23	2	1.7	14.6	Very Poor	
2	520	45	23	2	1.7	16.4	Very Poor	
2	570	50	25	2	1.4	18.3	Very Poor	
2	605	35	18	2	2.8	19.7	Very Poor	
2	645	40	20	2	2.2	21.3	Very Poor	1.9
2	675	30	15	2	3.8	22.5	Poor	
3	730	55	18	2	2.6	24.6	Very Poor	
3	780	50	17	2	3.1	26.6	Poor	
3	830	50	17	2	3.1	28.6	Poor	
3	870	40	13	2	4.9	30.1	Poor	3.4
3	905	35	12	2	6.3	31.5		
3	935	30	10	2	10.2	32.7		
3	980	45	15	2	3.8	34.5	Poor	6.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor                      CBR 5-10: Marginal  
 CBR 3-5: Poor                            CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	5 Feet	See Boring Log for more information.



### USACE DCP DATA SHEET

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA  
 DEPTH TO START OF TEST FROM SURFACE: 0 inches

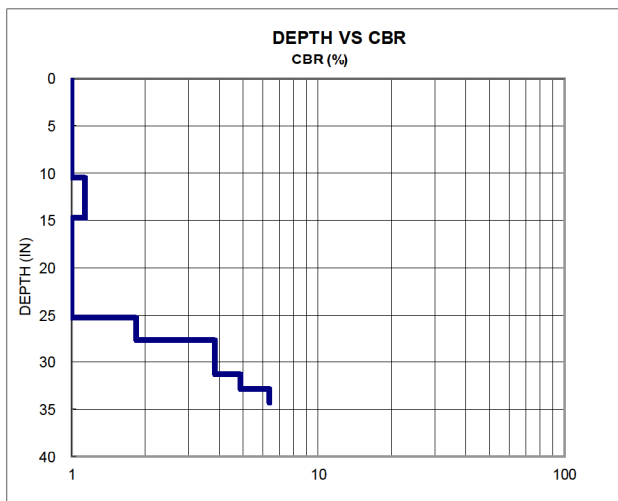
PROBE/CORE: HA-2  
 LOCATION: \_\_\_\_\_  
 LANE: \_\_\_\_\_  
 STATION: \_\_\_\_\_  
 OFFSET: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 GROUND EL: \_\_\_\_\_

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	90	0						
1	170	80	80	2	0.1	3.1	Very Poor	0.4
1	225	55	55	2	0.3	5.3	Very Poor	
2	295	70	35	2	0.7	8.1	Very Poor	
2	355	60	30	2	1.0	10.4	Very Poor	0.9
2	410	55	28	2	1.1	12.6	Very Poor	
2	465	55	28	2	1.1	14.8	Very Poor	
2	530	65	33	2	0.8	17.3	Very Poor	
1	580	50	50	2	0.3	19.3	Very Poor	
2	670	90	45	2	0.4	22.8	Very Poor	
2	730	60	30	2	1.0	25.2	Very Poor	
3	795	65	22	2	1.8	27.8	Very Poor	
3	840	45	15	2	3.8	29.5	Poor	4.6
3	885	45	15	2	3.8	31.3	Poor	
3	925	40	13	2	4.9	32.9	Poor	
3	960	35	12	2	6.3	34.3		

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



#### CBR Ranges for Subgrade Conditions

CBR < 3: Very Poor      CBR 5-10: Marginal  
 CBR 3-5: Poor      CBR > 10: Good

#### Depth to Groundwater From Surface

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	5 Feet	See Boring Log for more information.



**USACE DCP DATA SHEET**

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA

PROBE/CORE: HA-3  
 LOCATION: \_\_\_\_\_  
 LANE: \_\_\_\_\_  
 STATION: \_\_\_\_\_  
 OFFSET: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 GROUND EL: \_\_\_\_\_

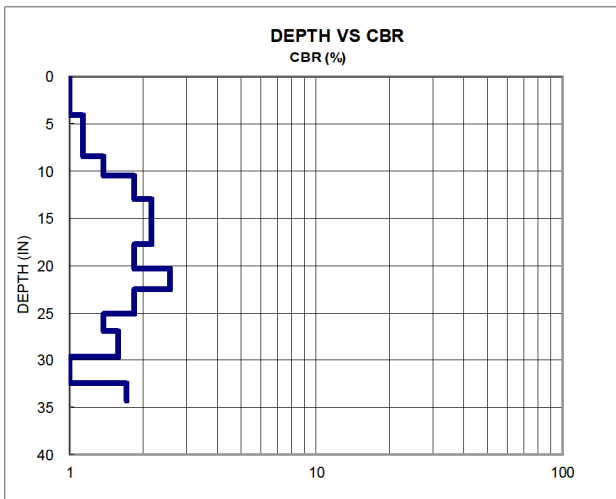
DEPTH TO START OF TEST FROM SURFACE: 0 inches

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	95	0						
1	155	60	60	2	0.2	2.4	Very Poor	
1	200	45	45	2	0.4	4.1	Very Poor	
2	255	55	28	2	1.1	6.3	Very Poor	
2	310	55	28	2	1.1	8.5	Very Poor	
2	360	50	25	2	1.4	10.4	Very Poor	
3	425	65	22	2	1.8	13.0	Very Poor	1.1
3	485	60	20	2	2.2	15.4	Very Poor	
3	545	60	20	2	2.2	17.7	Very Poor	
3	610	65	22	2	1.8	20.3	Very Poor	
3	665	55	18	2	2.6	22.4	Very Poor	
3	730	65	22	2	1.8	25.0	Very Poor	
2	780	50	25	2	1.4	27.0	Very Poor	
3	850	70	23	2	1.6	29.7	Very Poor	
2	920	70	35	2	0.7	32.5	Very Poor	
2	965	45	23	2	1.7	34.3	Very Poor	1.8

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor      CBR 5-10: Marginal  
 CBR 3-5: Poor      CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	5 Feet	See Boring Log for more information.



**USACE DCP DATA SHEET**

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA

PROBE/CORE: HA-4  
 LOCATION: \_\_\_\_\_  
 LANE: \_\_\_\_\_  
 STATION: \_\_\_\_\_  
 OFFSET: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 GROUND EL: \_\_\_\_\_

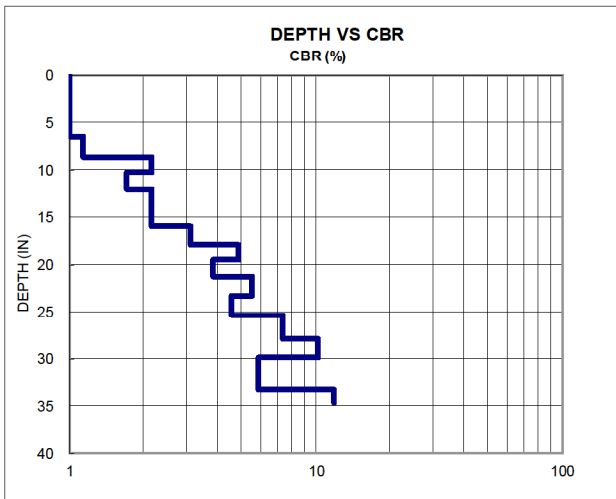
DEPTH TO START OF TEST FROM SURFACE: 0 inches

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	85	0						
1	170	85	85	2	0.1	3.3	Very Poor	
2	250	80	40	2	0.5	6.5	Very Poor	
2	305	55	28	2	1.1	8.7	Very Poor	
2	345	40	20	2	2.2	10.2	Very Poor	
2	390	45	23	2	1.7	12.0	Very Poor	0.9
2	430	40	20	2	2.2	13.6	Very Poor	
3	490	60	20	2	2.2	15.9	Very Poor	
3	540	50	17	2	3.1	17.9	Poor	
3	580	40	13	2	4.9	19.5	Poor	
3	625	45	15	2	3.8	21.3	Poor	3.1
4	675	50	13	2	5.5	23.2		
4	730	55	14	2	4.6	25.4	Poor	
6	795	65	11	2	7.4	28.0		
5	845	50	10	2	10.2	29.9		
7	930	85	12	2	5.9	33.3		
4	965	35	9	2	11.8	34.6		7.1

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor                      CBR 5-10: Marginal  
 CBR 3-5: Poor                              CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	4.5 Feet	See Boring Log for more information.



**USACE DCP DATA SHEET**

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA

PROBE/CORE: HA-5  
 LOCATION: \_\_\_\_\_  
 LANE: \_\_\_\_\_  
 STATION: \_\_\_\_\_  
 OFFSET: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 GROUND EL: \_\_\_\_\_

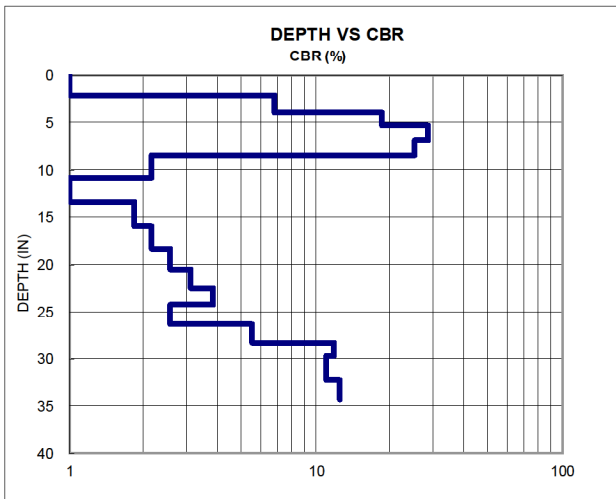
DEPTH TO START OF TEST FROM SURFACE: 0 inches

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	90	0						
1	145	55	55	2	0.3	2.2	Very Poor	
4	190	45	11	2	6.8	3.9		
6	225	35	6	2	18.6	5.3		
10	265	40	4	2	28.4	6.9		
9	305	40	4	2	25.3	8.5		
3	365	60	20	2	2.2	10.8		
2	430	65	33	2	0.8	13.4		
3	495	65	22	2	1.8	15.9		
3	555	60	20	2	2.2	18.3		
3	610	55	18	2	2.6	20.5		
3	660	50	17	2	3.1	22.4	Poor	
3	705	45	15	2	3.8	24.2	Poor	
3	760	55	18	2	2.6	26.4	Very Poor	3.1
4	810	50	13	2	5.5	28.3		
4	845	35	9	2	11.8	29.7		
7	910	65	9	2	11.1	32.3		
6	960	50	8	2	12.5	34.3		10.2

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor                      CBR 5-10: Marginal  
 CBR 3-5: Poor                              CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

**Depth of Frost From Surface :** N/E

From	To	Material
0	5 Feet	See Boring Log for more information.



### USACE DCP DATA SHEET

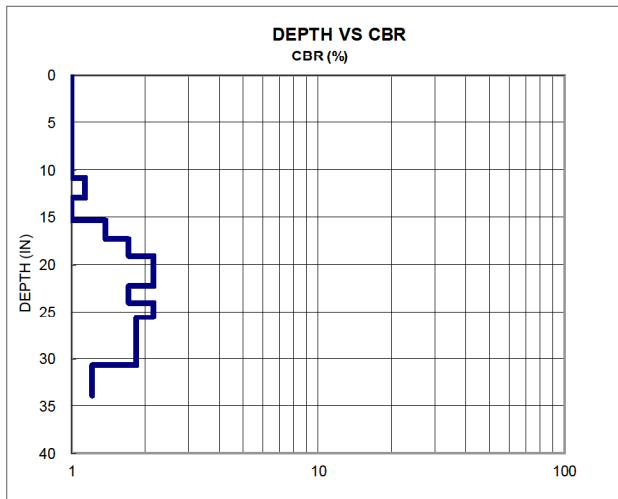
PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA  
 DEPTH TO START OF TEST FROM SURFACE: 0 inches

PROBE/CORE: HA-6  
 LOCATION: \_\_\_\_\_  
 LANE: \_\_\_\_\_  
 STATION: \_\_\_\_\_  
 OFFSET: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 GROUND EL: \_\_\_\_\_

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	95	0						
1	195	100	100	2	0.1	3.9	Very Poor	
1	250	55	55	2	0.3	6.1	Very Poor	
1	290	40	40	2	0.5	7.7	Very Poor	
1	335	45	45	2	0.4	9.4	Very Poor	
1	370	35	35	2	0.7	10.8	Very Poor	
2	425	55	28	2	1.1	13.0	Very Poor	
2	485	60	30	2	1.0	15.4	Very Poor	
2	535	50	25	2	1.4	17.3	Very Poor	0.6
2	580	45	23	2	1.7	19.1	Very Poor	
2	620	40	20	2	2.2	20.7	Very Poor	
2	660	40	20	2	2.2	22.2	Very Poor	
2	705	45	23	2	1.7	24.0	Very Poor	
2	745	40	20	2	2.2	25.6	Very Poor	
3	810	65	22	2	1.8	28.1	Very Poor	
3	875	65	22	2	1.8	30.7	Very Poor	
3	955	80	27	2	1.2	33.9	Very Poor	1.8

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor                      CBR 5-10: Marginal  
 CBR 3-5: Poor                            CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	4.5 Feet	See Boring Log for more information.







**USACE DCP DATA SHEET**

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA  
 DEPTH TO START OF TEST FROM SURFACE: 0 inches

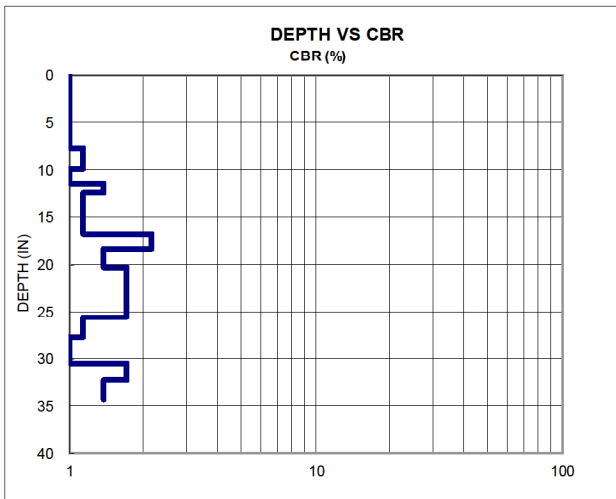
PROBE/CORE: HA-8  
 LOCATION: \_\_\_\_\_  
 LANE: \_\_\_\_\_  
 STATION: \_\_\_\_\_  
 OFFSET: \_\_\_\_\_  
 ADDRESS: \_\_\_\_\_  
 GROUND EL: \_\_\_\_\_

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	90	0						
1	185	95	95	2	0.1	3.7	Very Poor	
1	225	40	40	2	0.5	5.3	Very Poor	
2	285	60	30	2	1.0	7.7	Very Poor	
2	340	55	28	2	1.1	9.8	Very Poor	
1	380	40	40	2	0.5	11.4	Very Poor	
1	405	25	25	2	1.4	12.4	Very Poor	
2	460	55	28	2	1.1	14.6	Very Poor	
2	515	55	28	2	1.1	16.7	Very Poor	
2	555	40	20	2	2.2	18.3	Very Poor	0.9
2	605	50	25	2	1.4	20.3	Very Poor	
2	650	45	23	2	1.7	22.0	Very Poor	
2	695	45	23	2	1.7	23.8	Very Poor	
2	740	45	23	2	1.7	25.6	Very Poor	
2	795	55	28	2	1.1	27.8	Very Poor	
1	830	35	35	2	0.7	29.1	Very Poor	
1	865	35	35	2	0.7	30.5	Very Poor	
2	910	45	23	2	1.7	32.3	Very Poor	
2	960	50	25	2	1.4	34.3	Very Poor	1.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor      CBR 5-10: Marginal  
 CBR 3-5: Poor      CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	5 Feet	See Boring Log for more information.



**USACE DCP DATA SHEET**

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA  
 DEPTH TO START OF TEST FROM SURFACE: 0 inches

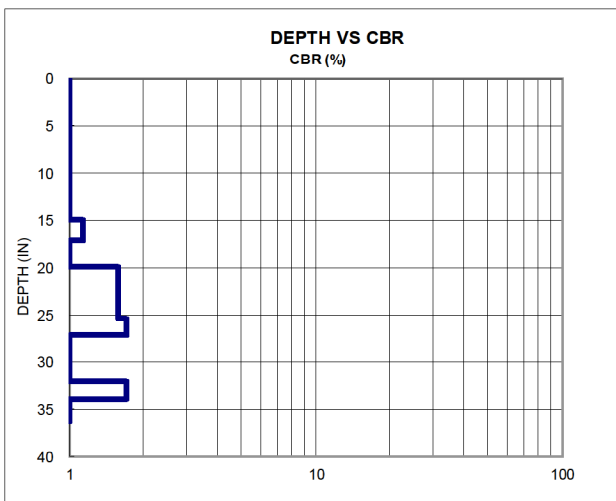
PROBE/CORE: HA-9  
 LOCATION:  
 LANE:  
 STATION:  
 OFFSET:  
 ADDRESS:  
 GROUND EL.:

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	75	0						
1	135	60	60	2	0.2	2.4	Very Poor	
1	190	55	55	2	0.3	4.5	Very Poor	
1	245	55	55	2	0.3	6.7	Very Poor	
2	330	85	43	2	0.5	10.0	Very Poor	
2	390	60	30	2	1.0	12.4	Very Poor	
2	455	65	33	2	0.8	15.0	Very Poor	
2	510	55	28	2	1.1	17.1	Very Poor	0.6
2	580	70	35	2	0.7	19.9	Very Poor	
3	650	70	23	2	1.6	22.6	Very Poor	
3	720	70	23	2	1.6	25.4	Very Poor	
2	765	45	23	2	1.7	27.2	Very Poor	
2	825	60	30	2	1.0	29.5	Very Poor	
2	890	65	33	2	0.8	32.1	Very Poor	
2	935	45	23	2	1.7	33.9	Very Poor	
1	995	60	60	2	0.2	36.2	Very Poor	1.1

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor                      CBR 5-10: Marginal  
 CBR 3-5: Poor                            CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	5 Feet	See Boring Log for more information.



**USACE DCP DATA SHEET**

PROJECT: Crestwood High School Athletic Field  
 PROJECT NO.: 088984.00  
 LOCATION: Dearborn Heights, Michigan  
 CLIENT: Crestwood School District  
 DATE: 5/5/22  
 BY: KPA  
 DEPTH TO START OF TEST FROM SURFACE: 0 inches

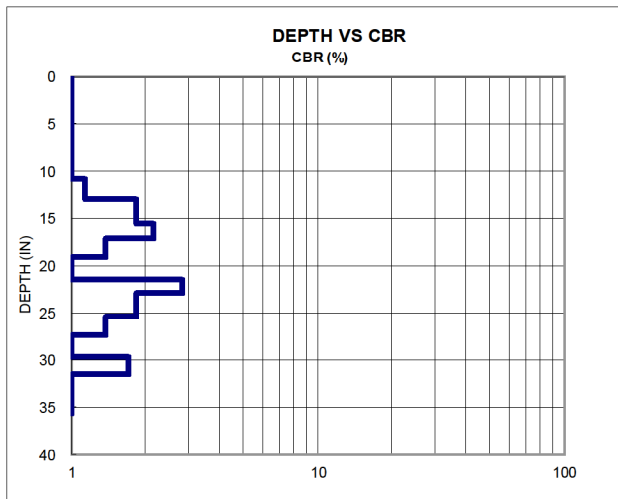
PROBE/CORE: HA-10  
 LOCATION:  
 LANE:  
 STATION:  
 OFFSET:  
 ADDRESS:  
 GROUND EL.:

No. of Blows	Accum. Pen. (mm)	Pen. per Blow Set (mm)	Pen. per Blow (mm)	Hammer Blow Factor	CBR (%)	Depth from Surface (inches)	Comment	Average CBR (%)
0	75	0						
1	160	85	85	2	0.1	3.3	Very Poor	
1	220	60	60	2	0.2	5.7	Very Poor	
2	310	90	45	2	0.4	9.3	Very Poor	
1	350	40	40	2	0.5	10.8	Very Poor	
2	405	55	28	2	1.1	13.0	Very Poor	
3	470	65	22	2	1.8	15.6	Very Poor	0.7
2	510	40	20	2	2.2	17.1	Very Poor	
2	560	50	25	2	1.4	19.1	Very Poor	
2	620	60	30	2	1.0	21.5	Very Poor	
2	655	35	18	2	2.8	22.8	Very Poor	
3	720	65	22	2	1.8	25.4	Very Poor	
2	770	50	25	2	1.4	27.4	Very Poor	
2	830	60	30	2	1.0	29.7	Very Poor	
2	875	45	23	2	1.7	31.5	Very Poor	
3	980	105	35	2	0.7	35.6	Very Poor	1.4

Hammer Blow Factor: 1 for 17.6 lb Hammer and 2 for 10.1 lb Hammer

NOTES:

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



**CBR Ranges for Subgrade Conditions**

CBR < 3: Very Poor                      CBR 5-10: Marginal  
 CBR 3-5: Poor                            CBR > 10: Good

**Depth to Groundwater From Surface**

During Drilling: N/E  
 Upon Completion: N/E

Depth of Frost From Surface : N/E

From	To	Material
0	4.5 Feet	See Boring Log for more information.

## **APPENDIX B**

### **IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT**

#### **GENERAL COMMENTS**

#### **LABORATORY TESTING PROCEDURES**

# Important Information about This

# 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.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

## Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer

will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

## Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

## You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

### Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site’s subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual site-wide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

### This Report’s Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

### This Report Could Be Misinterpreted

Other design professionals’ misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals’ plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

### Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note*

*conspicuously that you’ve included the material for information purposes only.* To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

### Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include 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 personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

### Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer’s recommendations will not of itself be sufficient to prevent moisture infiltration.* Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists.*



Telephone: 301/565-2733

e-mail: [info@geoprofessional.org](mailto:info@geoprofessional.org) [www.geoprofessional.org](http://www.geoprofessional.org)

## **GENERAL COMMENTS**

### **BASIS OF GEOTECHNICAL REPORT**

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

### **REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS**

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

### **REVIEW OF REPORT INFORMATION WITH PROJECT TEAM**

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

### **FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS**

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

### **PROJECT INFORMATION FOR CONTRACTOR**

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

### **THIRD PARTY RELIANCE/REUSE OF THIS REPORT**

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

# LABORATORY TESTING PROCEDURES

## VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

## MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110° C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

## HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

## TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

## LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440° C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

## ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a 1/2-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool 1/2 inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.





*Passionate People Building  
and Revitalizing our World*



This page intentionally left blank

---

**SECTION 00 4100  
BID FORM**

**THE PROJECT AND THE PARTIES**

**1.01 TO:**

- A. Crestwood School District (Owner)  
27235 Joy Road  
Dearborn Heights, MI 48127

**1.02 FOR:**

- A. Project: Crestwood High School Field Buildings
- B. Architect's Project Number: 5622  
1501 N. Beech Daly Road  
Dearborn Heights, Michigan 48127

**1.03 DATE: \_\_\_\_\_ (BIDDER TO ENTER DATE)**

**1.04 SUBMITTED BY: (BIDDER TO ENTER NAME AND ADDRESS)**

- A. Bidder's Full Name \_\_\_\_\_
  - 1. Address \_\_\_\_\_
  - 2. City, State, Zip \_\_\_\_\_
  - 3. Phone Number \_\_\_\_\_
  - 4. Email Address \_\_\_\_\_

**1.05 OFFER**

- A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Bid Documents prepared by Architect for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

- 1. Building A:

\_\_\_\_\_ dollars  
(\$ \_\_\_\_\_), in lawful money of the United States of America.

- 2. Building B:

\_\_\_\_\_ dollars  
(\$ \_\_\_\_\_), in lawful money of the United States of America.

- B. We have included the required Bid Bond as required by the Instruction to Bidders.
- C. We have included the required Performance Bond and Payment Bond in the Bid Amount as required by the Instructions to Bidders. The Bonds should be in the full contract sum (100%).
- D. All applicable federal taxes are included and State of Michigan taxes are included in the Bid Sum.
- E. **Submit two (2) hard copies of the bid forms prior to 2:00 p.m. on Tuesday, April 4, 2023. Provide an electronic copy (flash drive) of the entire Proposal including, but not limited to: the Proposal Form, Contractor Qualifications Form, Bid Security, Familial Relationship Disclosure Form, Affidavit of Compliance - Iran Economic Sanctions Act Form, Unit Prices Form, and Alternates Form. If a flash drive is not included, please email a copy of the bid documents to architects@ehresmanarchitects.com before noon on Wednesday, April 5, 2023.**

**1.06 ACCEPTANCE**

- A. This offer shall be open to acceptance and is irrevocable for 90 days from the bid closing date. Once the contract is executed, the office shall hold for the duration of the contract.
- B. If this bid is accepted by Owner within the time period stated above, we will:

1. Execute the Agreement within seven days of receipt of Notice of Award.
  2. Furnish the required bonds within seven days of receipt of Notice of Award.
  3. Commence work within seven days after written Notice to Proceed of this bid.
- C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.
- D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

#### **1.07 CONTRACT TIME**

- A. If this Bid is accepted, we will:
- B. Districts Desired Final Completion of the Work by Building A - Wednesday, October 4, 2023; Building B - Wednesday, September 6, 2023.. If this date is not achievable, please insert your timeline below.
- C. Contractor's Proposed Completion the Work by \_\_\_\_\_  
(Bidder to enter completion date or time frame.)

#### **1.08 CHANGES TO THE WORK**

- A. When Architect establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:
1. 10 percent overhead and profit on the net cost of our own Work;
  2. 10 percent on the cost of work done by any Subcontractor.
- B. On work deleted from the Contract, our credit to Owner shall be Architect-approved net cost plus 10 percent overhead and profit.

#### **1.09 ADDENDA**

- A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
1. Addendum # \_\_\_\_\_ Dated \_\_\_\_\_.
  2. Addendum # \_\_\_\_\_ Dated \_\_\_\_\_.
  3. Addendum # \_\_\_\_\_ Dated \_\_\_\_\_.
  4. Addendum # \_\_\_\_\_ Dated \_\_\_\_\_.

#### **1.10 BID FORM SUPPLEMENTS**

- A. The following information is included with Bid submission:
1. Unit Prices: 9
  2. Alternates: 2.
- B. The following Supplements are attached to this Bid Form and are considered an integral part of this Bid Form:
1. Document 00 4322 - Unit Prices Form: Include a listing of unit prices specifically requested by Contract Documents.
  2. Document 00 4323 - Alternates Form: Include the cost variations to the Bid Sum applicable to the Work as described in Section 01 2300 Alternates.

**1.11 BID FORM SIGNATURE(S)**

- A. The Corporate Seal of
- B. \_\_\_\_\_
- C. (Bidder - print the full name of your firm)
- D. was hereunto affixed in the presence of:
- E. \_\_\_\_\_
- F. (Authorized signing officer, Title)

**END OF SECTION**

This page intentionally left blank

**CONTRACTOR QUALIFICATIONS FORM**

1. Number of years your organization has been in business as a General Contractor/Construction Manager.  
\_\_\_\_\_
2. Number of years your organization has been business under its present name.  
\_\_\_\_\_
3. List other or former names under which your organization has operated.  
\_\_\_\_\_
4. Minimum Experience – at least three (3) comparable projects of similar type, scope, size and cost, with customer reference.

**REFERENCE #1**

Project Name: \_\_\_\_\_  
Location: \_\_\_\_\_  
Cost: \_\_\_\_\_  
Year: \_\_\_\_\_  
Contact Name: \_\_\_\_\_ Title: \_\_\_\_\_  
Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**REFERENCE #2**

Project Name: \_\_\_\_\_  
Location: \_\_\_\_\_  
Cost: \_\_\_\_\_  
Year: \_\_\_\_\_  
Contact Name: \_\_\_\_\_ Title: \_\_\_\_\_  
Phone: \_\_\_\_\_ Email: \_\_\_\_\_

**REFERENCE #3**

Project Name: \_\_\_\_\_  
Location: \_\_\_\_\_  
Cost: \_\_\_\_\_  
Year: \_\_\_\_\_  
Contact Name: \_\_\_\_\_ Title: \_\_\_\_\_  
Phone: \_\_\_\_\_ Email: \_\_\_\_\_

This page intentionally left blank





This page intentionally left blank



This page intentionally left blank

**SECTION 00 4322  
UNIT PRICES FORM**

**PARTICULARS**

**1.01 THE FOLLOWING IS THE LIST OF UNIT PRICES REFERENCED IN THE BID SUBMITTED BY:**

**1.02 (BIDDER) \_\_\_\_\_**

**1.03 TO (OWNER ): CRESTWOOD SCHOOL DISTRICT**

**1.04 DATED \_\_\_\_\_ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.**

**1.05 THE FOLLOWING ARE UNIT PRICES FOR SPECIFIC PORTIONS OF THE WORK AS LISTED,  
AND ARE APPLICABLE TO AUTHORIZED VARIATIONS FROM THE CONTRACT  
DOCUMENTS.**

**UNIT PRICE LIST**

**2.01 UNIT PRICE # 1: \$ \_\_\_\_\_**

**2.02 UNIT PRICE # 2: \$ \_\_\_\_\_**

**2.03 UNIT PRICE # 3: \$ \_\_\_\_\_**

**2.04 UNIT PRICE # 4: \$ \_\_\_\_\_**

**2.05 UNIT PRICE # 5: \$ \_\_\_\_\_**

**2.06 UNIT PRICE # 6: \$ \_\_\_\_\_**

**2.07 UNIT PRICE # 7: \$ \_\_\_\_\_**

**2.08 UNIT PRICE # 8: \$ \_\_\_\_\_**

**2.09 UNIT PRICE # 9: \$ \_\_\_\_\_**

**END OF SECTION**

This page intentionally left blank

**SECTION 00 4323  
ALTERNATES FORM**

**PARTICULARS**

**1.01 THE FOLLOWING IS THE LIST OF ALTERNATES REFERENCED IN THE BID SUBMITTED BY:**

**1.02 (BIDDER) \_\_\_\_\_**

**1.03 TO (OWNER ): CRESTWOOD SCHOOL DISTRICT**

**1.04 DATED \_\_\_\_\_ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.**

**ALTERNATES LIST**

**2.01 THE FOLLOWING AMOUNTS SHALL BE ADDED TO OR DEDUCTED FROM THE BID AMOUNT AS REQUIRED FOR EACH BID PACK. CONTRACTOR TO PROVIDE ONE (1) ALTERNATES FORM PER BID PACK SUBMITTED.**

**2.02 REFER TO SECTION 01 2300-ALTERNATES FOR EACH ALTERNATE DESCRIPTION.**

**ALTERNATE # 1: ADD / (DEDUCT) \$ \_\_\_\_\_**

**ALTERNATE # 2: ADD / (DEDUCT) \$ \_\_\_\_\_**

**END OF SECTION**

This page intentionally left blank



# DRAFT AIA® Document A101® - 2017

## Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

**AGREEMENT** made as of the « 5 » day of « December » in the year « 2022 »  
(In words, indicate day, month and year.)

**BETWEEN** the Owner:  
(Name, legal status, address and other information)

«Crestwood School District»«»  
«27235 Joy Road  
Dearborn Heights, MI 48127»  
«Telephone Number: (313) 278-0906»  
«»

and the Contractor:  
(Name, legal status, address and other information)

« »« »  
« »  
« »  
« »

for the following Project:  
(Name, location and detailed description)

«Crestwood School District - Crestwood High School Field Buildings »  
«1501 N. Beech Daly Road  
Dearborn Heights, MI 48127»  
« »

The Architect:  
(Name, legal status, address and other information)

«Ehresman Associates, Inc. d/b/a Ehresman Architects»«»  
«803 West Big Beaver Road  
Suite 350  
Troy, MI 48084»  
«Telephone Number: 248-244-9710»  
«Fax Number: 248-244-9712»

The Owner and Contractor agree as follows.

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

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

The parties should complete A101®-2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

**ELECTRONIC COPYING** of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

## TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

### EXHIBIT A INSURANCE AND BONDS

#### ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of the Request for Proposal dated March 20, 2023 (the "RFP"), the Contractor's Proposal (except to the extent any exceptions contained in the Contractor's Proposal are not expressly accepted by the Owner in writing or incorporated into the Agreement (hereinafter referred to as the "Agreement" or "Contract"), the Post Bid Interview Agreement (if any), Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, bid specifications and Owner-accepted portions of bid responses, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

#### ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall faithfully, competently, and fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. Except as expressly provided for in the Contract Documents to the contrary, the Contractor, at its sole cost, risk, and expense shall construct, install, equip, provide, purchase, pay for, and furnish all of the Work in accordance with the Contract Documents and Applicable Laws as they apply to the performance of the Work.

#### ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

*(Check one of the following boxes.)*

- The date of this Agreement.
- A date set forth in a notice to proceed issued by the Owner.
- Established as follows:  
*(Insert a date or a means to determine the date of commencement of the Work.)*
- 

If a date of commencement of the Work is not selected, then the date of commencement shall be the date set forth in a notice to proceed issued by the Owner.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

[  ] Not later than  (  ) calendar days from the date of commencement of the Work.

[  ] By the following date:  Building A - Wednesday, September 27, 2023; Building B - Wednesday, August 30, 2023

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
<input type="text"/>	<input type="text"/>

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be  (\$  ), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
<input type="text"/>	<input type="text"/>

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.

(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance
<input type="text"/>	<input type="text"/>	<input type="text"/>

§ 4.3 Allowances, if any, included in the Contract Sum:

(Identify each allowance.)

Item	Price
<input type="text"/>	<input type="text"/>

§ 4.4 Unit prices, if any:

(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)
<input type="text"/>	<input type="text"/>	<input type="text"/>

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

**§ 4.6 Other:**

*(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)*

« »

**§ 4.6.1** For any adjustments to the Contract Sum that are based on pricing other than unit price method and not required based upon the acts or omissions of the Contractor, the Contractor agrees to charge, and accept a mark-up of not more than ten percent (10%) on the Cost of the Work covered by the Change Order as the sole mark-up for the Contractor's overhead and profit. Mark-up for all subcontractor overhead and profit for Change Orders shall not exceed ten percent (10%) of their direct cost.

**ARTICLE 5 PAYMENTS**

**§ 5.1 Progress Payments**

**§ 5.1.1** Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

**§ 5.1.2** The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

**§ 5.1.3** Provided that an Application for Payment is received by the Architect not later than the « fifth » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the « twenty-sixth » day of the « same » month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « thirty » ( « 30 » ) days after the Architect receives the Application for Payment.

*(Federal, state or local laws may require payment within a certain period of time.)*

**§ 5.1.4** Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment. The Contractor's failure to provide a schedule of values, or to timely update it as Work progresses, shall be a substantial breach of this Agreement.

**§ 5.1.5** Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

**§ 5.1.6** In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

**§ 5.1.6.1** The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

**§ 5.1.6.2** The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

## § 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

*(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)*

« »

§ 5.1.7.1.1 The following items are not subject to retainage:

*(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)*

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:

*(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)*

« Any reduction in the retainage of this Agreement shall be in the sole discretion of the Owner, and the Owner reserves the right to restore the retainage to its full contract amount in the event the Owner believes the retainage restoration is desirable. »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:

*(Insert any other conditions for release of retainage upon Substantial Completion.)*

« Damages and expenses incurred by the Owner due to the Contractor's negligence or its breach of this Agreement and, in addition to other remedies available to the Owner, retainage may be used to pay such damages and expenses. »

§ 5.1.8 The Owner may withhold amounts from any progress payment as a setoff or recoupment for damages or losses incurred due to the Contractor's negligent acts or omissions or the Contractor's failure to perform under the requirements of the Contract Documents. Such withheld amounts shall not constitute retainage.

## § 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor no later than thirty (30) days after all of the following have been met:

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« It shall be a condition precedent that the Contractor submit a sworn statement and all full unconditional waivers of lien for all materials, labor, and major equipment suppliers to the project prior to final payment. »

**§ 5.3 Interest**

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

*(Insert rate of interest agreed upon, if any.)*

« 0 » % «per annum »

**ARTICLE 6 DISPUTE RESOLUTION**

**§ 6.1 Initial Decision Maker**

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker. *(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*

« »  
« »  
« »  
« »

**§ 6.2 Binding Dispute Resolution**

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:

*(Check the appropriate box.)*

« » ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

« X » ] Litigation in a court of competent jurisdiction

« » ] Other *(Specify)*

« »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

**ARTICLE 7 TERMINATION OR SUSPENSION**

**§ 7.1** The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

**§ 7.2** The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

**ARTICLE 8 MISCELLANEOUS PROVISIONS**

**§ 8.1** Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

**§ 8.2** The Owner’s representative:

*(Name, address, email address, and other information)*

«Penny L. Morgan»  
«27235 Joy Road  
Dearborn Heights, MI 48127»

«Telephone Number: (313) 378-2349»  
«>»  
«>»  
«Email Address: pmorgan@csdm.k12.mi.us»

§ 8.3 The Contractor's representative:  
(Name, address, email address, and other information)

« > »  
« > »  
« > »  
« > »  
« > »  
« > »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™-2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201-2017, may be given in accordance with AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

*(If other than in accordance with AIA Document E203-2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)*

« > »

§ 8.7 Other provisions:

« > »

**ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS**

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™-2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™-2017, General Conditions of the Contract for Construction

« > »

- .5 Drawings  
Refer to Attachment "A" attached hereto, which is part of the RFP.

Number	Title	Date

- .6 Specifications  
Refer to Attachment "B" attached hereto, which is part of the RFP.

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:

(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

« »

[ « » ] The Sustainability Plan:

Title	Date	Pages

[ « » ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™-2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

- « A. List of drawings - Attachment "A"
- B. Specification Table of Contents - Attachment "B"
- C. Section 00 1113 "Advertisement to Bid"
- D. AIA Document A 701-2018 "Instructions to Bidders"
- E. Contractor's Proposal
- F. Advertisement for Bid Dated: March 16, 2022
- G. Post-Bid Interview Questions (if any) »

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

«Penny L. Morgan», Chief Financial Officer»

(Printed name and title)

CONTRACTOR (Signature)

« »»

(Printed name and title)



# DRAFT AIA® Document A101® - 2017

## Exhibit A

### Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the « » day of « » in the year « »  
(In words, indicate day, month and year.)

for the following **PROJECT**:  
(Name and location or address)

«Crestwood School District - Crestwood High School Field Buildings »  
«1501 N. Beech Daly Road  
Dearborn Heights, MI 48127»

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

«Crestwood School District»«»  
«27235 Joy Road  
Dearborn Heights, MI 48127»

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

« »« »  
« »

#### TABLE OF ARTICLES

- A.1 GENERAL
- A.2 OWNER'S INSURANCE
- A.3 CONTRACTOR'S INSURANCE AND BONDS
- A.4 SPECIAL TERMS AND CONDITIONS

#### ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™-2017, General Conditions of the Contract for Construction.

#### ARTICLE A.2 OWNER'S INSURANCE

##### § A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

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

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

This document is intended to be used in conjunction with AIA Document A201®-2017, General Conditions of the Contract for Construction. Article 11 of A201®-2017 contains additional insurance provisions.

**ELECTRONIC COPYING** of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

**§ A.2.2 Liability Insurance**

The Owner shall be responsible for purchasing and maintaining the Owner’s usual general liability insurance.

**§ A.2.3 Required Property Insurance**

**§ A.2.3.1** Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk “all-risks” completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner’s property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

**§ A.2.3.1.1 Causes of Loss.** The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

*(Indicate below the cause of loss and any applicable sub-limit.)*

Causes of Loss	Sub-Limit

**§ A.2.3.1.2 Specific Required Coverages.** The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect’s and Contractor’s services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

*(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)*

Coverage	Sub-Limit

**§ A.2.3.1.3** Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

**§ A.2.3.1.4 Deductibles and Self-Insured Retentions.** If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

**§ A.2.3.2 Occupancy or Use Prior to Substantial Completion.** The Owner’s occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

**§ A.2.3.3 Insurance for Existing Structures**

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, “all-risks” property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

**§ A.2.4 Optional Extended Property Insurance.**

The Owner shall purchase and maintain the insurance selected and described below.

*(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)*

- [  ] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

- [  ] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

- [  ] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

- [  ] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

- [  ] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

- [  ] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

- [  ] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

**§ A.2.5 Other Optional Insurance.**

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[  ] § A.2.5.1 **Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. (Indicate applicable limits of coverage or other conditions in the fill point below.)

[  ] § A.2.5.2 **Other Insurance**  
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage

Limits

## ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

### § A.3.1 General

§ A.3.1.1 **Certificates of Insurance.** The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 **Deductibles and Self-Insured Retentions.** The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 **Additional Insured Obligations.** To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

### § A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:  
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

#### § A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than  One Million » (\$  1,000,000.00 ») each occurrence,  Two Million » (\$  2,000,000.00 ») general aggregate, and  Two Million » (\$  2,000,000.00 ») aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;

- .2 personal injury and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than « One Million » (\$ « 1,000,000.00 » ) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than « One Million » (\$ « 1,000,000.00 » ) each accident, « One Million » (\$ « 1,000,000.00 » ) each employee, and « One Million » (\$ « 1,000,000.00 » ) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » (\$ « » ) per claim and « » (\$ « » ) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » (\$ « » ) per claim and « » (\$ « » ) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » (\$ « » ) per claim and « » (\$ « » ) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than « » (\$ « » ) per claim and « » (\$ « » ) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than « » (\$ « » ) per claim and « » (\$ « » ) in the aggregate.

### § A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

*(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)*

« »

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

*(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)*

- [ « » ] § A.3.3.2.1 Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below: *(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)*

« »

- [ « » ] § A.3.3.2.2 **Railroad Protective Liability Insurance**, with policy limits of not less than « » (\$ « » ) per claim and « » (\$ « » ) in the aggregate, for Work within fifty (50) feet of railroad property.

- [ « » ] § A.3.3.2.3 **Asbestos Abatement Liability Insurance**, with policy limits of not less than « » (\$ « » ) per claim and « » (\$ « » ) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

- [ « » ] § A.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

- [ « » ] § A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[ « » ] **§ A.3.3.2.6 Other Insurance**

*(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)*

Coverage	Limits

**§ A.3.4 Performance Bond and Payment Bond**

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

*(Specify type and penal sum of bonds.)*

Type	Penal Sum (\$0.00)
Payment Bond	100% of Contract Sum
Performance Bond	100% of Contract Sum

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

**ARTICLE A.4 SPECIAL TERMS AND CONDITIONS**

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

« »

This page intentionally left blank





# AIA® Document A201® – 2017

## General Conditions of the Contract for Construction

**for the following PROJECT:**

*(Name and location or address)*

Crestwood School District - Crestwood High School Field Buildings  
1501 N. Beech Daly Road  
Dearborn Heights, MI 48127

**THE OWNER:**

*(Name, legal status and address)*

Crestwood School District  
27235 Joy Road  
Dearborn Heights, MI 48127

**THE ARCHITECT:**

*(Name, legal status and address)*

Ehresman Associates, Inc. d/b/a Ehresman Architects  
803 West Big Beaver Road  
Suite 350  
Troy, MI 48084

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

Init.

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 13:50:42 ET on 03/20/2023 under Order No.2114348013 which expires on 08/17/2023, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail docinfo@aiacontracts.com.

User Notes:

(1935763540)

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES



Init.

/

AIA Document A201 – 2017. Copyright © 1911, 1915, 1918, 1925, 1937, 1951, 1958, 1961, 1963, 1966, 1970, 1976, 1987, 1997, 2007 and 2017. All rights reserved. "The American Institute of Architects," "American Institute of Architects," "AIA," the AIA Logo, and "AIA Contract Documents" are trademarks of The American Institute of Architects. This document was produced at 13:50:42 ET on 03/20/2023 under Order No.2114348013 which expires on 08/17/2023, is not for resale, is licensed for one-time use only, and may only be used in accordance with the AIA Contract Documents® Terms of Service. To report copyright violations, e-mail [docinfo@aiacontracts.com](mailto:docinfo@aiacontracts.com).  
**User Notes:**

(1935763540)

## 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

Init.

/

## **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

Init.

/

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, 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, 2.3.32.4, 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

Init.

/

**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 Remedies**  
1.1.2, 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-Contract~~ between the Owner and Contractor (hereinafter the ~~Agreement-Contract~~) and consist of the ~~Agreement, Contract, 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, Contract, 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-Architect or Owner.~~ Unless specifically ~~enumerated-excluded~~ in the ~~Agreement, Contract,~~ 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-proposal (to the extent it does not conflict with Owner's bid documents), Project Manual,~~ 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.~~ consists of all goods and services, such as labor, transportation, materials, tools, and equipment (1) to be incorporated into the Project (or the Contractor's portion of the Project if the Contractor is not responsible for the entire Project), (2) required of the Contractor under the Contract Documents, or (3) necessary or appropriate to fully construct, fixture, operate and maintain the Project (or the Contractor's portion of the Contract if the Contractor is not responsible for the entire Project). The Work shall be performed in accordance with the Contract Documents. The Work may constitute the whole or a part of the Project. The term "Work" shall also include labor, materials, equipment and services provided or to be provided by subcontractors, sub-subcontractors, material suppliers or any other entity for whom the Contractor is responsible under or pursuant to the Contract Documents.

#### § 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 shall be the Architect, unless otherwise identified in the Contract 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.

### **§ 1.1.9 The Project Manual**

The Project Manual is a volume of documents assembled for the Work which may include the bidding requirement, sample forms, Conditions of the Contract, Specifications, Drawings, the Contract and other information furnished by the Owner.

### **§ 1.1.10 APPLICABLE LAWS**

Applicable Laws means all applicable federal, state and local codes, statutes, ordinances, laws including, but not limited to, the Americans with Disabilities Act ("ADA"), the Revised School Code, MCL 380.1 et seq., the School Building Construction Act, MCL 388.851 et seq., the Stille-Derosett-Hale Single State Construction Code Act, MCL 125.1501 et seq., the Michigan Building Code, and the rules and regulations, and lawful orders of all public authorities having jurisdiction over the Project, the Work site, the Work or the prosecution of the Work.

### **§ 1.1.11 CONSTRUCTION SCHEDULE**

The Construction Schedule is the Critical Path Method ("CPM") schedule for construction of the Work submitted as part of the Contractor's Proposal, prepared by the Contractor and approved by the Owner in writing in accordance with Section 3.10. The Construction Schedule can be modified only by Change Order. Following any such modification, the term "Construction Schedule" shall mean the most recent Owner-approved version. The initial agreed upon Construction Schedule is attached to the Contract as an Exhibit and is referred to as the Project Schedule. Sometimes in these General Conditions the term "Project Schedule" is used. It shall have the same meaning as the Construction Schedule.

### **§ 1.1.12 MILESTONE DATES**

The Milestone Dates are those dates included in the Construction Schedule that are critical to ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents.

### **§ 1.1.13 CONSTRUCTION TEAM**

The Construction Team includes the Contractor, Subcontractors, Sub-subcontractor at any tier and suppliers and (1) all other persons in privity of contract with any of them in connection with the Work (except the Owner), (2) anyone else providing labor, materials, supplies, equipment or services as part of or in connection with the Work (except those, if any, hired directly or indirectly by the Owner) and (3) all of their officers, employees, agents, and independent contractors.

### **§ 1.1.14 CONTRACT TIME**

The Contract Time is the number of calendar days described in the Construction Schedule in which (or, alternatively, the date set forth in the Construction Schedule by which) Substantial Completion shall be achieved, subject to any extensions granted in duly executed Change Orders or otherwise specifically permitted by the Contract Documents.

### **§ 1.1.15 EXTRAORDINARY MEASURES**

Extraordinary Measures are corrective measures necessary to expedite the progress of the Work, including (1) working additional shifts or overtime, (2) supplying additional manpower, equipment, and facilities, (3) expediting the delivery of materials, and (4) other similar measures. The Owner shall have the right to order the Contractor to take Extraordinary Measures when it determines that the performance of the Work, as of a Milestone Date, has not progressed to or reached the level of completion required by the Contract Documents, at Contractor's sole cost and expense.

### **§ 1.1.16 MASTER DESIGN AND CONSTRUCTION SCHEDULE**

The Master Design and Construction Schedule is the preliminary schedule for the Work to be developed by the Owner or Contractor during the bidding and negotiation process and which shall, at a minimum, provide for major elements such as preparation of the design, phasing of construction, the time of commencement and completion required for each anticipated Bid Package.

### **§ 1.1.17 PUNCHLIST**

Punchlist means a list of uncompleted or unacceptable items of Work which do not interfere with the use or occupancy of any part of the Work for its intended purpose and which, unless delayed by a need to order materials that could not reasonably have been anticipated by the Contractor, collectively are capable of being completed within sixty (60) days.

§ 1.1.18 The term "Product(s)" as used in the Contract Documents refers to the materials, systems and equipment provided by the Contractor for use in the Work of the Project.

§ 1.1.19 The terms "Warranty" and "Guarantee" as used in the Contract Documents shall have the same meaning and shall be defined as "legally enforceable assurance of satisfactory performance or quality of a product or "Work."

§ 1.1.20 Where materials, systems and equipment items are referred to in the singular, such reference shall not serve to limit the quantity required. The Contractor shall furnish quantities as required by the Contract Documents to complete the Work.

§ 1.1.21 Unless specifically limited in the Contract, the words "furnish," "install," and "provide," or any combination thereof mean to furnish and incorporate into the Work, including all necessary labor, materials, and equipment and other items required to perform the Work indicated.

#### § 1.1.22 VALUE ENGINEERING

Value Engineering means the detailed analysis of systems, equipment, materials, services, facilities, and supplies required by the Contract Documents for the purpose of achieving the desired and essential functions of the Owner's program at the lowest cost consistent with required and necessary performance, reliability, quality and safety.

§ 1.1.23 The words "consent," "approved," "satisfactory," "proper," "as directed," any derivatives of them, or similar terms, mean written approval by the Owner, and may include approval of the Architect if the Owner so directs. Except where a different standard is specifically established, the Owner has the right to grant or withhold such approval in its sole discretion.

§ 1.1.24 The word "provide" and any derivatives thereof, and similar terms, mean to properly fabricate, complete, transport, deliver, install, erect, construct, test and furnish all labor, materials, equipment, apparatus, appurtenances, and all items and expenses necessary to properly complete in place, ready for operation or use under the terms of the Contract Documents.

§ 1.1.25 The terms "known," "knowledge," "recognize," "believe," and "discover," and any derivatives thereof and similar terms, when used in reference to the Contractor, shall mean that which the Contractor knows or should reasonably know, recognized or should reasonably recognize, and discovers or should reasonably discover in exercising the care, skill, and diligence required of the Contractor by the Contract. The expression "reasonably inferable" and similar terms mean reasonably inferable by a Contractor familiar with the Work an exercising the care, skill and diligence required of the Contractor by the Contract.

§ 1.1.26 The word "including" shall not be a word of limitation, but instead shall be construed as introducing one or more nonexclusive examples.

§ 1.1.27 Words or abbreviations that are not defined but have well-known technical, trade or construction industry meanings, shall have those meanings ascribed to them. The singular shall include the plural and vice versa. Pronouns are interchangeable. The word "person" includes human beings and recognized legal entities. Unless the context clearly requires otherwise, reference to a section shall include all subsections beneath it bearing identical introductory numbers.

### **§ 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. Work called for on the Drawings and not mentioned in the specifications, or vice versa, shall be performed as though fully set forth in both. Nothing in this Section 1.2, however, shall relieve the Contractor of any of its obligations under the

Init.

/

Contract Documents. Other conflicts between or among the Contract Documents shall be resolved under the following rules of construction:

1. The specific shall govern over the general;
2. Specified dimensions shown on the Drawings shall govern, even though they may differ from dimensions scaled on the Drawings, if any;
3. Drawings of larger scale shall govern over those of smaller scale; any special Drawing details shall govern over standard detail;
4. Specifications shall govern over Drawings in matters of material or equipment specified; Drawings shall govern over Specifications in matters of construction or installation detail;
5. Documents of later date shall always govern; except that
6. the Owner's bid documents shall govern over Contractor's proposal; and
7. the Contract shall govern over all other documents, regardless of their dates .

**§ 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. Work not particularly detailed, marked or specified shall be the same as similar parts that are detailed, marked or specified. On certain Contract Documents, only a portion of the detail may be fully shown and the remainder indicated in outline, in which case the general detail shall be understood as applying also to other like portions of the Work. For example, if case carving, ornament, facing, veneer or similar treatment is indicated by starting of the detail, such detail must be continued throughout the course of parts in which it occurs, and to all similar parts in the Work wherever such general detail shall apply unless otherwise specifically provided in the Contract Documents. The organization of the specifications into divisions, selections, and/or articles, and the arrangement of the Drawings, shall not dictate to the Contractor in any way how the Work is to be divided among subcontractors, or establish the extent of Work to be performed by any trade. Similarly, the organization of the Contractor's duties into different phases or categories in the Contract is for convenience only and shall not limit the generality of the Contractor's obligation to provide all of the services whenever necessary.

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

**§ 1.2.4** All references in the Contract Documents to standards (such as commercial standards, federal specifications, trade association standards or similar standards), whether for materials, processes, assemblies, workmanship, performance or any other purpose, shall mean, unless otherwise noted, the most recent available published version of such standard as of the date of that part of the Contract Documents bearing the reference. All standards referred to, except as modified in the Contract Documents, shall have the same force and effect as though printed therein. These standards will not be furnished to the Contractor, as the Contractor and all members of the Construction Team are required to be familiar with their requirements.

**§ 1.2.5** Whenever a provision of the Contract Documents conflicts with agreements or regulations in force among members of trade associations, unions or councils, which regulate or distinguish the portions of the Work which shall or shall not be performed by a particular trade, the Contractor shall make necessary arrangements to reconcile the conflict without delay, damage, cost or recourse to the Owner. Delays in the Work resulting from the failure of the Contractor to use its best efforts to reconcile any such conflicts shall not result in an extension of the Contract Time and shall not result in the increase of the Contract Sum.

Init.

§ 1.2.6 The Contractor acknowledges that there may be items of the Work, which the Contractor is responsible to provide under the Contract that are not drawn or specified in the Design but are necessary for the proper execution and completion of the Work and are consistent with and reasonably inferable from the Drawings and Specifications. All such items shall be provided as part of the Work without delay in its progress and without any increase in the Contract Sum.

§ 1.2.7 Should there be conflicts or discrepancies in the Drawings or Specifications between the quality or type of work or material, the higher (more expensive) type or quality shall take precedence unless otherwise directed by the Architect, in writing.

§ 1.2.8 Unless otherwise stated in the Contract Documents, words and abbreviations which 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. Drawings, Specifications, Project Manual and all other documents, electronic or otherwise, and all data used in compiling, and the results of, any tests, surveys or inspections at the Project Site, as well as all photographs, drawings, specifications, schedules, data processing output, computer-aided design/drafting (CADD) system disks/tapes, computations, studies, audits, reports, models and other items of like kind, and all intellectual property, prepared or created for or in connection with the Project, regardless of whether they were prepared by the Owner, the Contractor, or a third party, shall constitute the Project Documents, and shall belong to the Owner. The Contractor may retain one set of the Project Documents. All copies of them, except Contractor's record set, shall be returned or suitably accounted for upon completion of the Work. They are for use solely with respect to the Project. The Contractor shall not, without the prior written consent of the Owner, use or permit anyone to use any Project Documents prepared for or in connection with the Project, or any concepts or ideas developed in connection with the Project, for any purpose other than the Project. The Owner shall at all times have access to and control over the disposition of any Project Documents pertaining to the Project. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Project Documents or 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 Owner's Architect's or Owner's 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.

**§ 1.6.3 The Contractor shall not knowingly or negligently communicate or disclose at any time to any person any information concerning the Work or the Project, except: (1) with prior written consent of the Owner, (2) information which has become part of the public domain prior to the Date of the Contract, (3) information which becomes part of the public domain by means other than an unauthorized act or omission of the Contractor, (4) as may be required to perform the Work or by any applicable law, or (5) to its professional advisors or lender (all of whom shall be required to maintain such information in confidence.)**

§ 1.6.4 The Contractor shall promptly upon the request of the Owner return and surrender to the Owner the original or legible copies of any materials, records, notices, memoranda, recordings, drawing, specifications and mock-ups and any other Project Documents furnished by the Owner to the Contractor.

§ 1.6.5 The Contractor shall maintain, and shall cause all members of the Construction Team, and its and their directors, officers, employees, and agents, to maintain during and after the term of the Contract, the confidentiality of all trade secrets, know-how, confidential data or other proprietary information of the Owner when designated as such and shall not use such information for any purpose whatsoever except for uses permitted by Section 1.7.1.

§ 1.6.6 The Contractor shall not identify, either expressly or by implication, the Owner, or its corporate affiliates, or use any of their trademarks, trade names, service marks, other proprietary marks, or reference the services performed under the Contract, in any advertising, press releases, publicity matters, or other promotional materials without the Owner's prior written approval.

§ 1.6.7 The Contractor shall not, without the express written consent of the Owner, discuss the Work or any part thereof with persons under circumstances in which such communications can reasonably be expected to be published in newspapers, magazines or trade journals or broadcast on radio or television. This restriction shall not apply to statements consistent with a crisis management plan development and agreed to by both parties with respect to the Work. This restriction also shall not apply to any fair response by the Contractor to publicity released by the Owner that is detrimental to the reputation of the Contractor. Any such contact shall be referred to the Owner for response. Further, without the Owner's consent, the Contractor shall not participate in professional or trade seminars or publish or submit articles for publication, the subject of which is, in whole or in part, the Work. Any such proposed article or publication shall be submitted to the Owner for review and approval, which shall not be unreasonably withheld.

§ 1.6.8 The Contractor shall cause all members of the Construction Team to specifically acknowledge that the provisions of this Section 1.7 are binding upon them.

### **§ 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 Contract~~ 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. may at any time and from time to time designate a third-party, such as an architect or engineer or other professional consultant, to perform any of its duties under the Contract. In the event of any such designation, the Owner shall provide written notice to the Contractor. The duties, responsibilities and limitations of authority of any third party designated by the Owner pursuant to Section 2.1.1, shall not be restricted, modified or extended without written consent of the Owner.~~

## **§ 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~~ increases 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. All permits, fees, licenses and approvals not specifically identified in the Contract or Contract Documents as the responsibility of the Owner shall be the responsibility of the Contractor.

**§ 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.

Init.

/



**§ 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. The Contractor shall immediately notify Owner of any errors, inaccuracies or problems which Contractor becomes aware of in the course of its use of the survey.

**§ 2.3.5** ~~The~~ Upon written request, 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. This right shall be in addition to and not in limitation of Owner's rights under any provision of the Contract Documents, and Owner's right to stop Work shall not relieve Contractor of any of its obligations under the Contract Documents.

#### **§ 2.5 Owner's Right to Carry Out the Work**

If the Contractor fails or defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ~~ten-day-five (5) day~~ five (5) day period after receipt of written notice from the Owner or the Owner's designee to commence and continue correction of such failure, 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 efficiencies, including any claim against the Contractor's Performance Bond, correct such deficiencies. In the event the Contractor's failure, default or neglect results in a threat to the safety of persons or property, the Contractor shall immediately correct such failure, default or neglect; otherwise, the Owner may undertake the same actions as permitted in the prior sentence. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including any and all legal expenses incurred to effectuate and enforce this provision 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-neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. In the event the Owner directs another entity to perform Work pursuant to this Section that otherwise is the obligation of the Contractor, including correction of safety violations, either at the Contractor's request or as a result of the Contractor's failure to perform such Work, that other entity shall charge the Contractor all costs for labor, material and equipment plus that other entity's administrative, profit and overhead costs. The Contractor shall pay that other entity within ten (10) days of the date of invoice. If not paid within ten (10) days, the Contractor authorizes the Owner to withhold that amount from the Contractor and to pay the same to that other entity from the next payment due the Contractor. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

**§ 2.5.1** Upon notification to the Contractor, the Owner shall have the right to place and install equipment and machinery during the progress of the Work before the completion of the various parts of the Work. Such placing and installing of equipment and machinery shall not in any way evidence the completion of the Work or any portion thereof by the Contractor, nor signify the Owner's acceptance of the Work or any portion thereof. If the Owner places or installs such equipment and machinery with its own forces, the Owner shall be responsible for any damage to Work

of the Contractor caused by the Owner's workers. If the Owner engages another contractor for such placement or installation, the Owner shall require said contractor to be responsible for such damages caused by its work, its workers, or its subcontractor(s). Upon discovery of any such damage, Contractor shall immediately notify Owner in writing.

#### §2.6 LIMITATION ON OWNER'S RESPONSIBILITY

§2.6.1 The Owner will not, under any circumstances, have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility. Owner will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents except the Architect shall provide services at no additional cost, made necessary by major defect or deficiencies in the Work of the Contractor(s) which, through reasonable care, should have been discovered by the Architect and promptly reported to the Owner and the Contractor(s), but which the Architect failed to so discover and/or report. Additionally, any design or Specification error furnished by the Architect shall be promptly corrected by the Architect at no cost to the Owner. The Owner will not have control over or charge of and will not be responsible for acts or omissions of any member of the Construction Team.

§2.6.2 The Contractor shall only be entitled to rely upon instructions and directions provided by the Owner's authorized representative(s).

§2.6.3 The Owner may, in addition to delivering them to the Architect, from time to time 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 the Owner's objectives and goals. Review of such submittals will not be conducted for the purpose of determining their accuracy and completeness of 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. The Owner's review and approval of or taking other appropriate action on the Contractor's submittals shall not relieve the Contractor or the Architect of any of their obligations. The Owner's approval of a specific item shall not indicate approval of an assembly of which the item is a component. The Owner's receipt of any informational submittals, of any submittals relating to equipment or system designed by the Contractor, or of any submittals relating to alternatives proposed by any member of the Construction Team shall not constitute approval of or action by the Owner on such submittals. All such submittals will be received by the Owner for record purposes only.

§2.6.4 The Owner may from time to time review or observe or take other appropriate action concerning the Work and any documents, and the selection of Subcontractors and Suppliers. The Owner's doing so shall be solely for the limited purpose of providing the Contractor with information as to how such items relate to the Owner's objectives and goals with respect to the Work and not for the purpose of determining their accuracy and completeness and shall in no way create any responsibility on the part of the Owner for or complicity by the Owner in errors, inconsistencies, or omissions, nor shall any such review, approval, other action or payment of the Contractor alter or in any way reduce the Contractor's obligations under the Contract.

### **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.

**§ 3.1.4 These General Conditions refer to the relationship between the Owner and Contractor. As to the contract between the Contractor and its Sub-Contractors, the General Conditions shall be read as the Contractor having the position of the Owner and the Sub-Contractors having the position of the Contractor. The Sub-Contractors are bound to the Contractor**

Init.

/

just as the Contractor is bound to the Owner. The Sub-Contractor shall have all the rights, duties and obligations to the Contractor as the Contractor has rights, duties and obligations to the Owner. The Sub-Contractors shall agree to and accept the same responsibility to the Owner as the Contractor. In the event any failure of a Sub-Contractor causes any type of injury or loss to the Owner, direct or indirect, the Contractor shall be jointly and severally liable to the Owner for such injury or damage in addition to any responsibility or liability of the Sub-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 (including weather 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 Documents.~~ The Contractor shall promptly report to the Owner and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Owner and 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. Failure by the Contractor to report to, or request clarification from, the Owner and Architect of any errors, omissions or inconsistencies shall result in interpreting and resolving such errors, omissions or inconsistencies in favor of the Owner and with no additional compensation to the Contractor.

§ 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 permits any construction activity to be performed that involves an error, inconsistency or omission in the Contract Documents or a physical condition at the Project Site it recognized or should, employing the degree of diligence required of that Contractor under the Contract Documents, have recognized without providing notice to the Owner and receiving authorization to proceed, the Contractor shall assume responsibility for such performance and bear all costs attributable to correction, without recovery, whether under the Contract Sum or otherwise. 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.~~ Construction Documents unless the Contractor recognized such errors, inconsistency, omission or difference and knowingly failed to report such to the Owner and Architect.

§ 3.2.6 If the Contractor encounters concealed or unknown conditions that differ materially from those anticipated or expected, the Contractor shall promptly notify the Owner, in writing of such conditions so that the Owner can determine if such conditions require design details, which differ from those design details shown in the Design or some other remedial action. The Contractor shall be liable to the Owner for any extra costs incurred as the result of the Contractor's failure to give such required notice.

### § 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

Init.

/

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~~. Subcontractors or Sub-subcontractors at any tier. References in the Contract Documents to, obligations or acts or omissions of Contractor shall apply to the Subcontractors, Sub-subcontractors at any tier, suppliers, materialmen, and those employees and agents, irrespective if they are identified.

**§ 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. Such provision of labor and materials shall occur in sufficient time to satisfy the existing Project Schedule. The Contractor bears the risk of any failure to timely provide such labor and materials for any reason. The Contractor agrees to execute the appropriate UCC forms to effectuate the Owner's ownership of the material and equipment furnished pursuant to this Contract to the extent the Owner has paid for services rendered.

**§ 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.

#### **§ 3.4.2.1 By making requests for substitutions based on Subparagraph 3.4.2 above, the Contractor:**

- 1. 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.**
- 2. Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified.**
- 3. Certifies that the cost data presented is complete and includes all related costs, including but not limited to the Architect's redesign costs; and waives all claims for additional costs related to the substitution which subsequently became apparent; and**
- 4. Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects.**

**§ 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.

**§ 3.4.3.1 The Contractor shall only employ labor on the Project or in connection with the Work capable of working harmoniously with all trades, crafts and any other contractors and individuals associated with the Project. The Contractor shall also minimize the likelihood of any strike, work stoppage or other labor disturbance.**

**§ 3.4.3.2 If the Work is to be performed by Trade Unions, the Contractor shall make all necessary arrangements to reconcile, without delay, damage or cost to the Owner and without recourse to the Architect or the Owner, any conflict between the Contract Documents and any agreements or regulations of any kind which regulate, control or distinguish what activities shall or shall not be included in the Work of any particular trade.**

§ 3.4.3.3 The Contractor shall cause pre-purchased equipment and material to be delivered to the Project Site or temporarily stored to assure coordination with other trades. The Contractor shall be responsible to verify that such equipment is in accordance with the Specifications.

**§ 3.4.3.4 To the extent practicable, materials and equipment will be delivered to the Project site in original containers or wrappings. Used materials or equipment will not be permitted to be incorporated into the Work without the written approval of the Architect and the Owner or unless specifically permitted or required by the Contract Documents. The Architect and the Owner shall have the right to have any such improperly used materials or equipment removed from the Project site or completed Work whenever detected. The Architect's or Owner's failure to detect such used materials or equipment shall not relieve the Contractor of its obligations under this paragraph. Neither the Architect nor the Owner shall have any obligation to inspect for or improperly detect used materials or equipment.**

§ 3.4.5 ASBESTOS, PCB, and Urea Formaldehyde-Free Product Installation.

§ 3.4.5.1 It is hereby understood and agreed that no product, substance, or material containing or treated with asbestos, including chrysolite, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, asbestos in vermiculite, erionite, and taconite (hereinafter collectively "asbestos"), polychlorinated biphenyls (PCB), or urea formaldehyde and any combination of these substances shall be installed or introduced into the Work by the Contractor, its employees, Subcontractors, Sub-subcontractors at any tier, and their respective agents and employees, and other persons performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors or Sub-subcontractors at any tier or other individuals or entities over whom the Contractor has control. The Contractor shall be required to provide a signed certification statement ensuring that all products or materials installed or introduced into the Work all be asbestos, PCB, and Urea Formaldehyde-free.

§3.4.5.2 The Contractor shall also be required to furnish certified statements from the manufacturers of supplied materials used during construction verifying their products or materials to be asbestos, PCB, and Urea-Formaldehyde-free in accordance with the requirements of Section 3.4.5.1.

§3.4.5.3 The Contractor shall complete and submit to the Owner a certification evidencing asbestos, PCB, and Urea Formaldehyde-free product and material installation prior to issuance of the final Certificate for Payment, in a form acceptable to the Owner.

### **§ 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. All warranties shall be in the form and substance required by the Owner and/or Contract Documents.**

In addition to any other warranties, guarantees or obligations set forth in the Contract Documents or applicable as a matter of a law and not in limitation of the terms of the Contract Documents, the Contractor warrants and guarantees that:

1. The Owner will have good title to the Work and all materials and equipment incorporated into the Work and, unless otherwise expressly provided in the Contract Documents, will be new;
2. The Work and all materials and equipment incorporated into the Work will be free from all defects, including any defects in workmanship or materials;

3. The Work and all equipment incorporated into the Work will be fit for the purpose for which they are intended;
4. The Work and all materials and equipment incorporated into the Work will be merchantable; and
5. The Work and all materials and equipment incorporated into the Work will conform in all respects to the Contract Documents.

Upon notice of the breach of any of the foregoing warranties or guarantees or any other warranties or guarantees under the Contract Documents, the Contractor, in addition to any other requirements in the Contract Documents, will commence to correct such breach within seventy-two (72) hours after written notice thereof and thereafter will use its best efforts to correct such breach to the satisfaction of the Owner; provided that if such notice is given after final payment hereunder, such seventy-two (72) hour period shall be extended to seven (7) days. The foregoing warranties and obligations of the Contractor shall survive the final payment and/or termination of the Contract.

§ 3.5.1.1 The Contractor shall assign to the Owner at the time of Substantial Completion any and all manufacturer's warranties relating to materials and labor used in the Work. Contractor shall perform the Work in a manner that will preserve any and all manufacturer's warranties.

§ 3.5.1.2 If the Contractor uses any portion of the Work or the Owner's other property, such items will be restored to the condition they were in immediately prior to such use at or before the time of Substantial Completion, or as otherwise specified in the Contract Documents. The Contractor's warranty and agreement to correct defective Work includes the Contractor's obligations under this section.

**§ 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 or portions thereof 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. The Contract Sum includes all such applicable taxes and the Contract Sum shall not be modified as a result of Contractor's failure to include all applicable taxes, or a change in Contractor's tax liability. The Contractor shall pay all state and federal taxes levied on its business, income or property and shall make all contributions for social security and other wage or payroll taxes. The Contractor shall be solely responsible for such payments and shall indemnify the Owner and hold it harmless from any assessment and payment of the same. Notwithstanding the foregoing, in the event any federal, state or local taxes are revised, changed or amended, the Contractor shall comply with all such revised, changed or amended taxes, provided however, to the extent such revisions, changes or amendments to such applicable taxes cause a material increase to Contractor's Contract Sum, the Owner and Contractor agree to negotiate in good faith a mutual agreeable reasonable adjustment, if any, to the Contractor's Contract Sum hereunder.

### **§ 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, and other permits, governmental fees, licenses and inspections by governmental agencies necessary for the proper execution, completion and occupancy of the Work, including without limitation, all connection charges, assessments and inspection fees imposed by the Michigan Bureau of Construction Codes, the Michigan Bureau of Fire Safety, any municipal agency or utility company. All such permit fees and charges are included in the Contractor's Contract Sum.

**§ 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 laws 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.

Init.

#### § 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. The Contractor shall notify the municipality, public utilities, agencies, Miss Dig and the Owner in a timely manner so as to allow reasonable response time before digging any tunnels or similar underground work, and shall protect all existing utilities, sidewalks, streets, and similar improvements while performing the Work.

§ 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~~ Architect by providing written and dated notification. 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~~ sufficient time to avoid delay in the work.

#### § 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. The superintendent shall be satisfactory to the Owner in all respects, and the Owner shall have the right to require the Contractor to remove any superintendent from the Project whose performance is not satisfactory to the Owner and to replace such superintendent with a superintendent who is satisfactory to the Owner; provided the request is made in good faith and for cause.

§ 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

Init.

/

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~~.~~delayed~~ except with another superintendant who is satisfactory to the Owner.

**§ 3.10 Contractor's Construction and Submittal Schedules**

**§ 3.10.1** The Contractor, promptly after being awarded or at times requested by the Owner or set forth in the Contract, shall submit for the Owner's and Architect's information a Contractor's proposed 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.~~

**§ 3.10.1.1** The Construction Schedule shall be in a detailed format satisfactory to the Owner which shall also: (1) provide a graphic representation coordinating and sequencing all activities and events that will occur during performance of the Work; (2) identify each phase of construction and occupancy; (3) set forth Milestone Dates and manpower loading.

**§ 3.10.1.2** The Construction Schedule shall allow for and depict the following:

1. Local weather conditions;
2. Local jurisdictional or other work restrictions;
3. Specific restrictions, constraints and Contract completion dates stipulated in the Contract Documents;
4. Intermediate completion dates stipulated in the Contract Documents;
5. Time for needed submittals by the Contractor and needed approvals by the Owner, Architect, or other agency or authority;
6. Owner, Architect, or other agency or authority inspections and/or tests where required by the Contract Documents;
7. The work of separate contractors or the Owner;
8. Necessary resources to accomplish the Work within the Contract Time;
9. Other information that may be provided by the Architect or the Owner; and
10. A legend for each report or chart which clearly identifies how to interpret each .

**§ 3.10.1.3** Upon review and acceptance by the Owner, the Construction Schedule shall be deemed part of the

1. the Construction Schedule, subject to any modification granted in accordance with the Contract, shall constitute the Contractor's scheduling commitment to the Owner.

Init.



2. The Contractor shall meet at least bi-weekly with the persons providing labor or materials under each trade package to review their progress and take appropriate action to maintain the Construction Schedule.
3. The accepted Construction Schedule shall be updated (1) monthly to compare actual progress with projected progress and (2) at any other time if requested by the Owner. The updated Construction Schedule shall reflect the status of the Project's progress at the date of update and the Contractor's planned progress of remaining portions of the Work.
4. The Contractor shall develop recovery schedules when milestone dates are or may be at risk.
5. The Contractor is responsible for the completeness of the Construction Schedule. The Contractor shall confirm in writing, with each submission of the Construction Schedule, that the Contractor has reviewed the Construction Schedule with Subcontractors and Suppliers and has coordinated and allowed for the lead times associated with the delivery of materials or equipment required for the proper progress of the Work.
6. The sequence of activities in the Construction Schedule will reflect the Contractor's intended approach to the execution of and completion of the Work. The Construction Schedule shall be broken into work areas to provide for a clear identification of the Planned Progress of the Work.
7. The Owner's or the Architect's review of Construction Schedule shall not constitute or imply the acceptance of or relieve the Contractor of the responsibility for the means, methods, sequences, techniques or procedures used in the performance of the Work.
8. The Construction Schedule shall represent the Contractor's plan for organizing, directing, managing, controlling, staffing and executing the Work required by the Contract Documents. The Owner shall have the right to rely on such Construction Schedule to coordinate and otherwise plan the work of the Owner, Architect, or other separate contractors, and to evaluate progress for payment purposes or other purposes as described in the Contract Documents.
9. At the completion of the Work and as a condition precedent to final payment to the Contractor, the Contractor shall submit two (2) copies of the final updated Construction Schedule to the Owner.

§ 3.10.1.4 The Contractor shall proceed strictly (not substantially) in accordance with the Construction Schedule. The Contractor shall monitor the progress of the Work for conformance with the requirements of the Construction Schedule and shall promptly advise the Owner of any delay or potential delays. If any progress report indicates any delays, the Contractor shall, at no cost to the Owner, propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment of the Contract Time or any Milestone Date or the Construct Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to a Change Order. The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect and incorporated into the approved Project Schedule.

§3.10.1.5 The Contractor shall cooperate in scheduling and performing its Work to avoid conflict or interference with the Work of others, and shall be responsible for any such conflict or interferences caused. The Contractor acknowledges and understands that the work schedule will be modified from time-to-time to work around the work of other contractors, in an effort to avoid conflicts or interference in the work of the Contractor or other contractors, and that such schedule changes do not give rise to a claim for damages by the Contractor for delay or otherwise. If the schedule for the Work is revised, the Contractor shall conform to the most recent schedule. The Contractor acknowledges that the schedule may change during the duration of the Project and that fact was taken into account by the Contractor when it agreed to the Contract Sum and entered into this Contract under the terms of the conditions set forth herein. As a result, the Contractor shall not be entitled to any additional monies or damages as a result of such schedule changes and the Contractor agrees that the Project Schedule, as modified, shall be an accepted term and contractual requirement. The Contractor shall complete work in accordance with the Project Schedule and Milestone Schedule(s).

§ 3.10.1.6 The Contractor shall cooperate in working out the proper sequence of operations between the Work of the Contractor and that of other trades on the Project site. The Contractor acknowledges that the schedule for the Work may change during the duration of the Project and the Contractor took that fact into account when it entered into the Contract. As a result, the Contractor shall not be entitled to any additional monies or damages as a result of such schedule changes.

§ 3.10.1.7 Contractor shall prosecute the Work undertaken in a prompt and diligent manner whenever such Work, or any part of it, becomes available, or at such other time or times as the Owner or Architect may direct so as to promote the general progress of the entire construction. The Contractor shall not, by delay or otherwise, interfere with or hinder the Work or the work of any other Contractor. Any materials that are to be furnished by the Contractor shall be furnished in sufficient time to enable the Contractor to perform and complete its Work within the time or times provided in the schedule. If the Contractor shall, through its action or inactions, including the actions or inactions of its' subcontractors or suppliers, fall behind in furnishing necessary labor and/or materials to meet the construction needs in accordance with the established schedule, then it shall increase its forces or work such overtime as may be required, at its own expense, to bring its part of the work up to the proper schedule. In the event that Contractor does not take such action necessary to bring its part of the work up to schedule within twenty-four (24) hours of receiving notice from the Owner or Architect, then, as allowed by, the Owner may supplement Contractor's forces or remove Contractor from the Project and retain others to complete part or all of the remainder of Contractor's Work. Contractor shall be responsible for any and all costs of performing or completing the Work. Contractor shall pay any such sums within ten (10) days of date of invoice. If not paid within ten (10) days, the amount will be withheld from Contractor and paid to the relevant parties from next payment due Contractor.

§ 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~~constructed together with a certification that they are "as-built" documents.

### **§ 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. All Work shall be furnished and installed in accordance with the Drawings, Specifications and as additionally required by the manufacturer's printed instructions. The Contractor shall review the manufacturer's instructions, and where conflict occurs between the Drawings or Specifications and the manufacturer's instructions, the Contractor shall request clarification from the Architect prior to commencing 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

Init.

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.

**§ 3.12.5.1** **The Contractor shall check thoroughly all such submittals, including those it prepares itself, as to measurements, sizes of members, materials and all other details, to assure that they conform to the intent of the Contract Documents.**

**§ 3.12.5.2** **The Contractor shall promptly return to the Subcontractors and/or Suppliers, for correction, any of the submittals that are found inaccurate or otherwise erroneous be corrected.**

**§ 3.12.5.3** **After the Contractor has checked and approved such submittals, the Contractor shall place thereon the date of its approval and the legible signature of the individual who reviewed them and shall then submit them to the Architect for review. The Architect may refuse to check or review any submittals, which are not submitted in compliance with these requirements.**

**§ 3.12.5.4** **Submittals describing manufactured equipment must be "Project Specific." Every submission copy must be clearly marked to fully define the intended model number, configuration and other applicable product information.**

**§ 3.12.5.5** **Among other things, the Contractor shall be responsible for the constructability, content, completeness and consistency of all submittals.**

**§ 3.12.5.6** **The Contractor shall notify the Owner when submittals are received. It shall deliver copies to the Owner upon request.**

**§ 3.12.5.7** **The Contractor shall notify the Owner and the Architect in writing if any submittals appear to modify the requirements of the Contract Documents. This notice shall identify each and every change.**

**§ 3.12.5.8** **The Contractor shall furnish to the Architect for review when requested, or when required by the Contract Documents, samples of all materials and finishes to be used in the execution of the Work. Such samples shall be of sufficient size to be representative and the required number of them shall be submitted before the Work utilizing the materials they exemplify is commenced and in ample time to permit examination thereof. In all cases, samples shall be submitted at least three (3) weeks prior to when approval is needed to maintain the progress required by the Construction Schedule. All materials furnished and finishes applied to the Work shall be fully equal to the submitted samples.**

- 1.** **Samples shall be forwarded to the Architect with all shipping charges prepaid. Unless otherwise directed, samples shall be submitted in triplicate, boxed or wrapped properly, each labeled with the name, type or brand of the materials, its place of origin, the names of its producer, Contractor and the Project.**
- 2.** **The approval of Samples is generally directed towards establishing quality, color and finish criteria, and does not modify the requirements of the Contract Documents at to dimensions or design.**

**§ 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.

**§ 3.12.6.1** **The Architect will check and review the submittals with reasonable promptness and within any time limits agreed upon in writing and will return them as hereinafter described, indicating by notation, or by written instructions,**

Init.

/

or other directions, any corrections, which in the judgment of the Architect, may be necessary to meet the requirements of the Contract Documents. The Contractor shall then review such notations, instructions, or directions, and if the Contractor concurs therein, shall make or have made such corrections, and shall, when so noted on the submittals or requested by the Architect, resubmit corrected submittals to the Architect as soon as possible, for final check and review. Such final check and review by the Architect of submittals so corrected and resubmitted will be limited to the corrections only, and the Contractor, by such resubmission shall be held to have represented that such submittals contain no other alterations, additions, or deletions, unless the Contractor, in writing, directs the Architect's specific attention to same. Should the Contractor question or disagree with such notations, instructions, or directions, the Contractor shall direct the Architect's attention to same for further clarification before resubmitting them. Corrections or changes indicated on submittals shall not be construed as an order for a change in the Work or to perform extra work.

§ 3.12.6.2 The Architect's review of 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 of systems, all of which remain the responsibility of the Contractor. The Architect does not assume responsibility for errors, omissions or deviations from the Contract Documents contained in such submittals. Any such errors, omissions or deviations from the Contract Documents must be corrected by the Contractor, irrespective of the receipt and review of the submittals by the Architect, and even through the Work is done in accordance with such submittals, unless such error, omission or deviation from the Contract Documents is specifically called to the Architect's attention by the Contractor in a separate written letter of communication, at the time of submittal, and the Architect has given written approval of such error, omission or deviation.

**§ 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~~ Applicable Laws, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment. Only materials and equipment which are to be used for the Project or carry out the Work shall be stored at the Project site. Protection of such materials and equipment shall be the sole responsibility of the Contractor. No off-site storage is permitted without the Owner's prior written consent.

§ 3.13 .1 No member of the Construction Team shall erect any sign on the Project Site without the Owner's prior written consent.

§ 3.13 .2 The Contractor shall ensure that the Work is at all times performed in a manner that affords the Owner, the Architect, and the Owner's separate contractors reasonable access, both vehicular and pedestrian, to the Project Site and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the Project site shall be free from all debris, building materials and equipment. Without limiting any other provision of the Contract Documents, the Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of (1) any areas and buildings adjacent to the Project site or (2) portions of the Project in which Work is not being carried out in the event of partial occupancy.

§ 3.13 .3 The Contractor shall not, without the Owner's prior written approval, permit any workers to use any existing Architect, and the Owner's separate contractors reasonable access, both vehicular and pedestrian, to the Project Site and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the Project site shall be free from all debris, building materials and equipment. Without limiting any other provision of the Contract Documents, the Contractor shall use its best efforts to minimize any interference with the occupancy or beneficial use of (1) any areas and buildings adjacent to the Project site or (2) portions of the Project in which Work is not being carried out in the event of partial occupancy.

1. Should any room or part of an existing building or facility be temporarily used by any member of the Construction Team as a shop, storeroom, locker room, an office, or for any other purpose, such room or part shall, prior to completion and when so directed, be thoroughly cleaned and returned to its original condition. All damage to any such room or part of an existing building or facility arising therefrom shall be corrected, and the whole left in a condition acceptable to the Owner by the Contractor. No room or part of an existing structure shall be so used without the prior written consent of the Owner.

§ 3.13.4 Anything contained in the Contract Documents to the contrary notwithstanding, no one except the Owner shall be permitted to disrupt the operation of any building system, utilities, or any other services without the Owner's prior written consent. Any request to perform such work shall be in writing, received by the Owner no less than five (5) days prior to the commencement of the requested disruption, and shall detail (1) the exact nature and duration of such interruption, (2) the area affected, and (3) any impact upon the Construction Schedule caused by such proposed temporary disruption. Except in the case of extraordinary measures, all Work shall be performed during the hours and on the days set forth in the Specifications. The Contractor's failure to comply with the notice provisions of this section shall constitute a waiver by the Contractor of any right it may have to an adjustment of its Contract Sum, or the Contract Time, on account of any postponement, rescheduling, or other delays ordered by the Owner in connection with any Work affecting a critical service for which appropriate notice was furnished.

§ 3.13.5 The Contractor will consult with the Owner concerning any necessary operations at the Project site, including staging area limits, office or storage trailer locations, dumpster operations, equipment and material deliveries, hoisting areas and any other construction impacts on the Owner's grounds.

§ 3.13.6 The Contractor shall provide suitable toilet facilities, at locations approved by the Owner, for the use of all its employees and those of the Construction Team and shall maintain same in proper sanitary condition acceptable to the Owner. All temporary toilet facilities shall be removed upon completion of the Work. The Contractor or any of its

Init.

/

employees, agents or Subcontractors shall not use any toilet facilities of Owner's buildings without the Owner's prior written consent.

### **§ 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. Only skilled tradespersons shall perform any cutting, fitting, or patching work.

**§ 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 Contractor, its employees, Subcontractors, Sub-Subcontractors at any tier, and their respective agents and employees, and other persons performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors or Sub-subcontractors at any tier shall keep the Project site 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, keep the Project site clean as required by the Owner or as provided in the Contract Documents or fails to clean up the Project site upon completion, the Owner may do so and the Owner shall be entitled to reimbursement for all costs and expenses for clean up 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 indemnify and hold harmless the Owner and Architect harmless from any and all costs, damages, and losses, including, but not limited to, actual attorneys' fees, 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. Contractor shall indemnify, defend and hold harmless the Owner, its Board and its Board Members in their official and individual capacities, its administrators, employees and agents, from and against all claims, counter-claims, suits, debts, demands, actions, judgments, liens, injuries, liabilities, costs, expenses, damages, and actual attorney fees and actual expert witness fees arising out of or in connection with Contractor's performance of the Work pursuant to the Contract Documents and/or from Contractor's violation of any of the terms of the Contract, including, but not limited to: (1) the~~

negligent acts or willful misconduct of the Contractor, its officers, directors, employees, agents and Subcontractors; (2) any breach of the terms of the Contract by the Contractor, its officers, directors, employees, agents and Subcontractors; (3) any violation of applicable state and/or federal law, rule, ordinance, policy or regulations and/or licensing and permitting requirement applicable to providing the Work by its officers, directors, employees, agents and Subcontractors; or (4) any breach of any representation or warranty by the Contractor under the Contract by its officers, directors, employees, agents and Subcontractors. The Contractor shall notify the Owner by certified mail, return receipt requested, immediately upon knowledge of any claim, suit, action, or proceeding for which it may be entitled to indemnification under the Contract. This paragraph shall survive the expiration or earlier termination of the Contract. In addition to and not in limitation of the Contractor's other indemnity obligations, the Contractor hereby accepts and assumes exclusive liability for and shall indemnify, protect and save harmless the Owner and Architect from and against the payment of the following:

All contributions, taxes or premiums (including interest and penalties thereon) which may be payable under the unemployment insurance law of any state, the federal Social Security Act, federal, state, county and/or municipal tax withholding laws, or any other law, measured upon the payroll of or required to be withheld from employees by whomsoever employed, engaged in the Work to be performed and furnished under the Contract;

All sales, use, personal property and other taxes (including interest and penalties thereon) required by any federal, state, county, municipal or other law to be paid or collected by the Contractor or any of its Subcontractors or vendors or any other person or persons acting for, through or under it or any of them, by reason of the performance of the Work or the acquisition, ownership, furnishing, or use of any materials, equipment, supplies, labor, services or other items for or in connection with the Work; and

All pension, welfare, vacation, annuity and other benefit contributions payable under or in connection with respect to all persons by whomsoever employed, engaged in the Work to be performed and furnished under the Contract.

The Contractor shall indemnify, defend and hold the Owner harmless from any claim, damage, loss or expense, including but not limited to actual attorney fees, incurred by the Owner related to any hazardous material or waste, toxic substance, pollution or contamination brought into the Project site or caused by the Contractor or used, handled, transported, stored, removed, remediated, disturbed or dispersed of by Contractor.

§ 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.

### **§ 3.19 Record Documents**

**§ 3.19.1 The Contractor shall maintain at the Project site on a current basis for review by the Owner, the Architect, and all members of the Construction Team, the Record Documents, which include: a record copy of all logs, reports, Contract Documents, and Record Drawings, in good order and marked to record all changes made during construction; all approved Shop Drawings, Product Data, Samples, and other submittals; applicable handbooks; maintenance and operating manuals and instructions; and other related documents and revisions which arise out of the Contract Documents or the Work. As part of the Record Documents, the Contractor shall maintain records of principal building layout lines, elevations of the bottoms of footings, project floor levels and key site elevations certified by a qualified surveyor. The Contractor shall at all times make all records (excluding internal memoranda or reports, privileged communications and documents with incidental references to the Work, or documents which discuss multiple projects) available to the Owner and the Architect, and, at the completion of the Work, shall deliver all such Record Documents to the Owner neatly organized, bound and indexed. The Contractor shall monitor preparation of as-built Drawings by Subcontractors on a monthly basis and shall take corrective action as appropriate when as-builts are not being properly updated. The Contractor shall be permitted to retain a copy of the Record Documents for its own use after the Work is completed and, in any event, the Owner shall continue to provide access to the Record Documents, for the Contractor to inspect and copy.**

§ 3.19.2 The Record Drawings shall be prepared and updated during the prosecution of the Work. The prints for Record Drawing use will be a set of blackline prints provided by the Architect to the Contractor at the start of construction. The Contractor shall maintain said set in good condition and shall use colored pencils or other methods

Init.

reasonably acceptable to the Owner to mark up said set with "record information" in a legible manner to show: (1) deviations from the Drawings made during construction; (2) details in the Work not previously shows; (3) changes to existing conditions or existing conditions found to differ from those shown on any existing drawings; (4) the actual installed position of equipment, piping, conduits, light switches, electric fixtures, circuiting, ducts, dampers, access panels, control valves, drains, openings and stub-outs; and (5) such other information as the Owner may reasonably request.

§ 3.19.3 The Contractor shall keep note of all the deviations and discrepancies in the underground, concealed conditions and other items of construction and the Work on field Drawings. At the completion of the Project the Contractor's notes on the record field Drawings shall be neatly transcribed onto a clean set of Drawings furnished by the Architect. The Contractor shall submit the final Record Drawings to the Architect for review.

§ 3.19.4 During construction, the Contractor shall maintain on the Project site, a separate, clean set of Drawings for the sole purpose of recording changes and actual 'as installed' information. This set shall be accessible for inspection by the Owner and the Architect at all times. The Contractor shall bring this set of Drawings to the scheduled construction progress meetings. The Contractor shall record all information as the Work progresses, clearly and neatly, in color and maintain it on a current basis as directed by the Owner and submit these Drawings to the Owner within thirty (30) days after Substantial Completion. As a general guide, the type of information to be recorded includes, but is not limited to: (1) revisions made except minor or non-critical dimensional changes, (2) omissions, including Work omitted by Change Order or accepted alternates, (3) exact dimensioned locations of concealed lines, (4) locations of all control devices, (5) any additions to Work, (6) changes in significant details, (7) and any other information of a similar nature.

§ 3.19.5 Upon substantial completion of the Project, the Contractor shall submit to the Owner the Contractor's mechanical and electrical coordination Record Drawings prepared during construction by the Contractor. Examples of such drawings include sheet metal ductwork drawings, piping drawings, fire protection piping drawings, electrical raceway drawings, and the like. When the Contractor produces drawings by computer aided drafting, the Contractor shall also submit their coordination drawings on electronic data files compatible with AutoCAD computer software. All such documents shall contain the Owner's Project Number for identification purposes.

#### § 3.20 Warranties and Manuals

§ 3.20.1 Unless the Contract Documents require otherwise, the Contractor shall bind and turn over to the Owner two (2) sets of manufacturers' warranties and operating and/or maintenance manuals, instructions, or schedules for all equipment and special materials requiring such. Such binders will clearly categorize and index each piece of equipment and material included, and shall be clearly marked noting "Project Specific" equipment, model numbers, and other applicable information. Such manuals will be collected and organized by the Contractor and submitted to the Owner at one time, prior to the issuance of the certificate of substantial completion.

### **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 Contract.

**§ 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

Init.



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. The Contractor shall reimburse Owner for all costs and expenses for the Architect's time to interpret and decide matters it deems clear and unambiguous.

§ 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. The Contractor shall, and shall cause all Subcontractors to comply with an interpretation and decisions of the Architect.

§ 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 agreement,~~ written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the

Init.

/

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.

§ 5.3 .1 Work performed for the Contractor by a Subcontractor shall be performed pursuant to a written subcontract, which shall (in addition to the requirements of Sections 5.3 and 5.4) contain provisions that:

1. which shall (in addition to the requirements of Sections 5.3 and 5.4) contain provisions that: Contract Documents;
2. Requires timely submission of Subcontractor's applications for payment and ancillary materials in order to enable the Contractor to apply for payment in accordance with the provisions of Article 9;
3. Waives all rights to contracting parties may have against one another or that the Subcontractor may have against the Owner for damages caused by fire or other perils covered by the property insurance described in Article 11;
4. Recognizes the rights of the Owner pursuant to the Contingent Assignment of Subcontracts contained in these General Conditions and require the Subcontractor (upon notice by the Owner that the Owner has terminated the Contract with the Contractor pursuant to the terms of Article 14, and that the Owner has elected to retain the Subcontractor pursuant to the terms of its Subcontract with the Contractor) to complete the unperformed obligations under such Subcontract and, if requested by the Owner, to enter into an appropriate agreement evidencing the fact that the Subcontractor is bound to the Owner under its Subcontract in the manner in which it had been bound to the Contractor;
5. Requires the Subcontractor performing labor at the Project site to carry and maintain the insurance described in Article 11, unless otherwise approved by the Owner, and to deliver certificates of insurance to the Contractor prior to commencement of its portion of the Work;
6. Includes the following sentence: "Owner is an intended third-party beneficiary of this Subcontract.";
7. Requires each Subcontractor to make all claims for changes or extensions of time to the Contractor strictly (not substantially) in the manner provided in the Contract;
8. Limits claims and damages in the manner provided in the Contract; and
9. Are in no way inconsistent with any provision of the Contract;
10. Requires the Subcontractor to indemnify the Owner the same extent required under Section 3.18.

Sub-subcontracts and supply contracts shall be subject to identical conditions, except: (1) suppliers that are not performing any Work on the Project site are not subject to the insurance requirements described in Article 11; and (2) Subcontractors and Sub-subcontractors may satisfy the insurance requirements described in Article 11 by being named as an additional insured under the Contractor's insurance policies or, in the case of a Sub-subcontractor, by being named as an additional insured under a Subcontractor's insurance policies.

§ 5.3.1.2 Upon request, the Contractor shall deliver a copy of any Subcontract, Sub-subcontract or Supply Contract to the Owner.

Init.

§ 5.3.2 Coordination of Subcontractors

§ 5.3.2.1 The Contractor shall provide supervisory, administrative, management, inspection and related services as required to properly coordinate, schedule and sequence the Work of the Subcontractors with each other (to avoid both duplication and omission of Work) and with the activities and responsibilities of the Contractor, the Owner and the Architect to complete the Work in accordance with the requirements of the Contract Documents with respect to cost, time and quality and to ensure that the other goals of the Work are otherwise met or exceeded.

§ 5.3.2.2 The Contractor shall schedule and conduct with the Subcontractors and Sub-subcontractors construction progress and any other meetings deemed necessary to discuss such matters as procedures, progress, problems, safety, inspections, sequencing, and scheduling, and shall prepare and promptly distribute minutes. Construction progress meetings will be conducted by the Contractor weekly unless otherwise directed by the Owner and attended by all Subcontractors and Sub-subcontractors whose Work has not been completed. Executive level progress meetings will be held on a monthly basis. All progress meetings minutes shall be provided to the Owner by the Contractor within five (5) days after the meeting and distributed to all attendees promptly after they have been approved by the Owner. The Owner will act promptly in providing its approval.

§ 5.3.2.3 Schedule of Subcontractors' Work. The Contractor shall require each Subcontractor to agree to be contractually bound to the requirements of the Construction Schedule. The Contractor shall require each Subcontractor to agree to cooperate with the Contractor in developing a detailed schedule applicable to its portion of the Work within fourteen (14) days after award of contract unless otherwise specified. The Contractor shall assist in the development of all Subcontractor schedules and shall prepare such schedules if any Subcontractor fails to do so. The Contractor shall require all Subcontractors to meet as often as necessary with the Contractor to complete their detailed schedules. However, the Construction Schedule will take precedence over any schedules prepared by Subcontractors with respect to time of completion for each bid package. If any such schedule indicates that additional time or effort will be required to maintain these schedules, the Contractor, Subcontractor shall agree to work additional time, including weekends if necessary, or to add manpower, all at no extra cost to the Owner. The Contractor will require all their subcontractors to include the requirements in Sections 5.3.2.3 and 5.3.2.4 in their sub-subcontractor contracts.

§ 5.3.2.4 Subcontractors' Performance. The Contractor shall ensure satisfactory and timely (with reference to both Milestone and Substantial Completion Dates) performance from each of the Subcontractors. The Contractor shall take appropriate measures when any Subcontractor is not performing its obligations satisfactorily.

§ 5.3.2.5 Payments to Subcontractors. Upon award of the Subcontract, the Contractor shall have each Subcontractor prepare and submit a schedule of values allocating that portion of the Cost of the Work attributable to its Subcontract to the various portions of the Work. Each schedule of values shall be prepared in a form and substance acceptable to the Contractor (which form shall previously have been approved by the Owner) and supported by such data as may be necessary to substantiate its accuracy. The Contractor shall develop and implement procedures for the review and processing of applications by Subcontractors for progress and final payments. Payment packages shall include, but shall not be limited to, each of the following documents: schedule of values, sworn statements, and appropriate forms of full or partial construction lien waivers or other similar waivers and releases of claims.

§ 5.3.2.6 Safety Programs. The Contractor shall provide a general review of safety programs developed by each of the Subcontractors, including a verification that each Subcontractor has submitted its report of the recommended safety precautions and programs, as required by the Contract Documents. If the Contractor observes a safety violation, the Contractor shall require a Subcontractor to correct it. After written notification to the Subcontractor to correct the safety violation, if the Subcontractor does not correct the problem in a timely fashion, the Contractor shall cause the Work to be corrected by other means. The performance of such services by the Contractor shall not relieve the Subcontractors of their responsibilities for performance of the Work and for the safety of persons and property, and for compliance with all federal, state and local statute, rules, regulations and orders applicable to the conduct of the Work. The Contractor shall conduct regular safety meetings with Subcontractors' superintendents to ensure the Subcontractors' compliance with federal, state or local statutes, rules, and regulations relating to the Workers' safety or any other aspect of the Work.

§ 5.3.2.7 Work. The Contractor shall determine in general that the Work of each Subcontractor is being performed in accordance with the requirements of the Contract Documents, and shall guard the Owner against defects and deficiencies in the Work. As appropriate, the Contractor shall require special inspection or testing, or make recommendations to the Architect regarding special inspection or testing, of Work not in accordance with the provisions of the Contract Documents whether or not such Work has been then fabricates, installed or completed, and shall reject Work which does not conform to the requirements of the Contract Documents. The Contractor shall coordinate any inspections which may be required by any governmental agencies.

§ 5.3.2.8 Interpretation. The Contractor shall consult with the Architect and the Owner if any Subcontractor requests interpretations of the meaning and intent of any of the Contract Documents, and shall assist in the resolution of questions, which may arise.

§ 5.3.2.9 Insurance Certificates. The Contractor shall receive certificates of insurance from the Subcontractors, and shall review such certificates for compliance with the requirements of the Contract Documents, and shall forward the original certificates to the Owner. No member of the Construction Team shall be permitted to commence any portion of the Work or have a presence at the Project Site without complying with all insurance requirements of the Contract Documents. The Contractor shall monitor the same to ensure the certificates of insurance remain current, and shall advise the Subcontractors of the impending expiration of their respective certificates, but the failure of Contractor to give such advice shall not, as between the Contractor and any of the Subcontractors, excuse the obligation of the Subcontractors to maintain current, unexpired certificates.

§ 5.3.2.10 System Readiness. The Contractor shall, in the company of the Architect and the Owner's maintenance personnel, observe the Subcontractors' evaluation of utilities, operational systems and equipment for readiness, and shall assist in their initial start-up and testing.

§ 5.3.2.11 Contractor and Subcontractors' Warranty Acknowledgment. The Contractor shall execute and deliver to the Owner, and shall cause anyone giving warranties that is contractually bound to the Contractor to execute and deliver to the Owner, the following Warranty Acknowledgment before a Certificate of Final Completion is issues:

#### **WARRANTY ACKNOWLEDGMENT**

**(Name of Subcontractor) ("Contractor") warrants that all of its Work complies with the requirements of the Contract Documents. If, within one (1) year after the date of Substantial Completion of the Work or designated portion of the Work, any of Contractor's Work is found to be not in accordance with the requirements of the Contract Documents, Contractor shall correct the Work at its sole expense promptly after receipt of written notice from the Owner. This one (1) year period shall be extended (1) with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of Contractor's Work, and (2) with respect to warranty work for an additional One (1) year period following each correction. This obligation shall survive acceptance of the Work and termination of our contract.**

**This warranty shall be in addition to the terms of any other warranty or longer period of obligation specified in the Contract Documents, any applicable special warranty required by the Contract Documents, or the terms of any general warranty and is not in lieu of any of them. This warranty shall not be construed to establish a period of limitation with respect to other obligations which Contractor might have under the Contract Documents and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced or to the time which any proceeding may be commenced.**

#### **§ 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 but assumes no obligation 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~~-insurance.

§ 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~~-Owner-ContractorContract.

§ 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 including costs 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.

Init.

§ 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.

**§ 6.2.6 Subject to the provisions of, and rights to recover from, any property insurance that the Owner is responsible to maintain, the Contractor shall, at its expense, without recovery from the Owner, under the Contract Sum, any contingency or otherwise, promptly remedy damage caused by any member of the Construction Team to completed or partially completed construction or to property of the Owner or separate contractors.**

**§ 6.2.7 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.**

### § 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 and Owner will allocate the cost among those ~~responsible~~ responsible in their sole discretion. The Owner's right to clean up shall in no event be deemed a duty, and should the Owner choose not to pursue this remedy, the Contractor necessitating such action shall remain fully responsible for the same.

## 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~~ Directive, written contract amendment, 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~~ alone with the Owner's prior approval.

§ 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.

**§ 7.1.4 Changes in the Work maybe made without notice to the Contractor's sureties, and absence of such notice shall not relieve such sureties of any of their obligations to the Owner. If notice of any extra Work or change in the Work affecting the general scope of the Work or the provisions of the Contract Documents is required by the provisions of any bond, to be given to any surety issuing such bonds, the giving of any such notice shall be the Contractor's sole responsibility.**

### § 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.

**§ 7.2.2 Written agreement by the Owner, Architect and Contractor on any Change Order shall constitute a final settlement of and a waiver of and permanent bar to all claims by Architect or Contractor relating to the change in the Work which is the subject to the Change Order, including all direct and indirect costs associated with such change and any and all adjustments to the Contract Sum and the Contract Time. The Contractor shall include the Work covered by such Change Orders in its Applications for Payment as if such Work were originally part of the Contract Documents.**

### § 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

Init.

/

Sum and Contract Time being adjusted accordingly. However, the Contract Time shall only be adjusted if the Contractor demonstrates the Construction Change Directive adversely affects the Construction Schedule.

§ 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 with the Owner's approval 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, the Contract,~~ or if no such amount is set forth in ~~the Agreement, a reasonable amount.~~ Contract, a reasonable amount, however, any such change shall not exceed five percent (5%) in the changes in the work. 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 undisputed Work completed under the Construction Change Directive in Applications for Payment. ~~The~~ For those undisputed amounts, 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~~ cost, if



agreed to by the Owner in writing 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 in writing with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the ~~adjustments~~, adjustments in writing, 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.

**§ 7.3.11 In no event shall the Contractor be entitled to receive, and the Contractor hereby waives the right to receive any payment or any extension of time for additional or changed work, whether partially or fully completed or simply proposed, unless such additional work is authorized by a written Change Order or Construction Change Directive signed by the Owner, nor shall the Contractor be obligated to proceed with any such work. Only the Owner shall have the right to issue a written Change Order or Constructive Change Directive to the Contractor authorizing an addition, deletion or other revision in the scope of the Work and/or an adjustment in the Contract Sum or the Construction Schedule.**

#### § 7.4 Minor Changes in the Work

~~The Architect~~ Architect, with the Owner's written approval, 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.~~

See Section 1.1 for Basic Definitions.

§ 8.1.2 The date of commencement of the Work is the date established in ~~the Agreement~~ the Contract.

§ 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 Contract, the Contractor confirms that the Contract Time ~~is~~ and the construction schedule contain 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.~~ see to the diligent, expeditious performance of the Work, with adequate resources so that all the Work will be completed within the Contract Time. The Contractor shall require overtime, multiple shifts and any other action necessary to complete of the Work within the Contract Time, all without additional cost to the Owner except as otherwise specifically provided in Section 8.4 in a Change Order or Construction Change Directive. The Contractor shall not, without the Owner's prior written approval, reschedule or re-sequence the Work that will cause the date of Substantial Completion to be modified so that an action, approval, or activity of the Owner moves onto the critical path or otherwise becomes critical to the Contract Time so long as such action, approval, or activity would not in fact have been critical but for the rescheduling or re-sequencing.

**§ 8.2.4 Should the Contractor fail, refuse or neglect to supply sufficient workers or to cause the delivery of equipment and materials promptly to prevent delay, or fail in any material respect to commence and prosecute the Work diligently in accordance with the Contract Documents, or if the Work falls behind schedule, the Owner may require the Contractor to**

Init.

take Extraordinary Measures and to have the members of the Construction Team do likewise, all at no additional cost to or compensation from the Owner unless otherwise agreed to in writing by the Owner. Such Extraordinary Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the Construction Schedule.

1. The Contractor shall not be entitled to an adjustment in its compensation in connection with Extraordinary Measures required by the Owner under or pursuant to this Article 8 except as specifically provided in Section 8.4.2 or in a Change Order or Construction Change Directive.
2. The Owner may exercise the rights furnished it under or pursuant to this Article 8 as frequently as necessary to ensure that the Contractor's performance of the Work will comply with any Milestone Date or completion date set forth in the Contract Documents.
3. Subject to reasonable prior notice and opportunity to cure, and except to the extent caused by Owner delay, the Owner shall also have the right to offset against any amounts then or thereafter due to the Contractor, or to be reimbursed by the Contractor for, any costs incurred as a result of an increase in the Owner's own labor force or for overtime, Saturday, Sunday, and/or holiday work as a result of implementing Extraordinary Measures for which the Contractor is responsible to pay.

### **§ 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. Except as provided in this Section 8.3, the Contractor shall be fully responsible for the timely completion of the Work in accordance with the Construction Schedule. The Contractor will use its best efforts to cause all members of the Construction Team to meet all Milestone Dates in the Construction Schedule and shall not be liable for delay caused by the Owner or Architect. The Contractor agrees to use its best efforts to avoid the occurrence of any cause for delay, to avoid any extension of performance dates, and to mitigate the effect of any delay that does occur. The Contract Time will be extended only under the exact circumstances described in this Section 8.3 and then if and only if the Contractor complies strictly (not substantially) with the requirements of this Section 8.3.

§ 8.3.1.1 If the Contractor shall be delayed by: (1) the combined action of workman (either those employed on the Work or in any industry essential to the conduct of the Work) in no way caused by or resulting from default or collusion on the part of the Contractor. (2) by strikes, lockouts, embargoes, fire, unavoidable casualties, unusual delays in transportation, national emergency, unusually severe and adverse weather conditions not reasonably anticipated, or (3) by any other causes which the Contractor could not reasonably control or circumvent, and if such delay affects the critical path activity, then the Project Construction Schedule shall be adjusted as necessary to compensate for such delay (but the total extension of all activities may not exceed the length of the delay).

§ 8.3.1.2 All claims for extension of time shall be made in writing to the Owner no more than ten (10) days after the commencement of the delay; otherwise they shall be waived. IN the case of a continuing cause of delay only one claim is necessary. Any delay of less than twenty-four (24) hours duration shall not be justification for adjusting the Project Construction Schedule. Any claims shall include documented schedule and impact on the projects critical path.

§ 8.3.1.3 No adjustments shall be made under this Section 8.3 for any suspension, delay or interruption (i) to the extent that performance would have been so suspended, delayed or interrupted by an other cause, including the fault or negligence of the Contractor, or (ii) for which an equitable adjustment is provided or excluded under any other provision of this Contractor, or (iii) delay or failure to obtain permits for approval from government authorities, or (iv) strikes, or labor disturbances against the Owner, the Contractor, and/or other contractors and embargoes. Neither the Owner's exercise of any of its rights under this Contract, nor the issuance of Change Orders, regardless of the extent or numbers of such changes, nor the Owner's requirement of correction or re-execution of any defective work shall, under any circumstances, be construed as interference with the Contractor's performance of the work.

§ 8.3.1.4 The Contractor shall make no claim in damages for delay in the performance of this Contract occasioned by any act or omission of the Owner, Architect, or public authority having jurisdiction over the Work or any of their representatives, and agrees that compensation for any such claim shall be limited to an extension of time to complete performance of the Work as provided herein.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15. Notices in connection with delays shall be made by the Contractor to the Owner in accordance with this Section 8.3.2. The Contractor shall use its best efforts to provide verbal notice to the Owner within twenty-four (24) hours after the commencement of a delay. It must in any event do so as soon as possible and not later than three (3) days after commencement of the delay. Any verbal notice given shall be confirmed in writing within four (4) days. If the Contractor fails to deliver verbal notice within three (3) days after the commencement of a delay, it shall not be entitled to any relief pertaining to the period of time before it gave verbal notice. If the Contractor fails to confirm any verbal notice within four (4) days after the verbal notice was given, it shall not be entitled to any relief for the period of time beginning after the passage of such four (4) days and ending when the confirmation is actually received by the Owner. And, if the Contractor fails to provide verbal notice within ten (10) days after the commencement of a delay or to confirm any verbal notice in writing within ten (10) days after the verbal notice was given, the Contractor shall be barred from seeking any relief whatsoever relating to the delay. The Contractor shall submit such information as may be required by the Owner to evaluate the Change Order Request. The Owner shall decide whether to grant, grant in part or deny the Change Order Request. Any extension of time or adjustment granted shall be memorialized in the form of a Change Order.

§ 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. Except in the case of changes to the Work covered by Article 7 or failure of the Owner to pay the Contractor for Work performed, the Contractor shall not be entitled to an extension of time unless set forth in a Change Order. The Contractor acknowledges that in preparing the Construction Schedule and in agreeing to the times or dates of completion required by the Contract Documents it will make a reasonable allowance for commercially anticipated delays. Adjustments in the Contract Time will be permitted only to the extent such delay (1) is not caused or contributed to, and could not have been anticipated, by the Contractor using the degree of diligence required by the Contract Documents, (2) could not be limited or avoided by the Contractor's timely notice to the Owner of the delay, and (3) is of a duration of not less than one (1) day.

§ 8.3.4 The Owner's exercise of any of its rights under the Contract Documents or the Owner's good faith exercise of The Owner's exercise of any of its rights under the Contract Documents or the Owner's good faith exercise of any of its remedies, including requirement of correction or re-execution of any defective Work, regardless of the extent, number or frequency of the Owner's good faith exercise of such rights or remedies, shall not under any circumstances be construed as unreasonable interference with the Contractor's performance of the Work or an event of default.

§ 8.3.5 The Contractor shall use its best efforts to mitigate the effects of any delay.

§ 8.3.6 This Section 8.3 does not preclude the recovery of other damages by the Owner for delay under other provisions of the Contract. However, the Contractor acknowledges that the Schedule for the Work may change during the duration of the Project and that fact was taken into account by the Contractor when it agreed to the Contract Sum and entered into this Contract under the terms and conditions set forth herein. As a result, the Contractor shall not be entitled to any additional monies as a result of such schedule changes.

#### § 8.4 No Damage for Delay

§ 8.4.1 Except only as provided in Section 8.4.2 below, an extension in the Contract Time or adjustment of the Construction Schedule, to the extent permitted under Section 8.3, and the Contractor's rights in connection with a suspension of the Work, as provided in the Contract, shall be the sole and exclusive remedies (in lieu of all other remedies whatsoever) of the Contractor for any delay, interference, hindrance in the performance of the Work, loss of productivity, manpower inefficiencies, impact damages and similar claims and damages, whether or not contemplated by the parties. Except only as provided in Section 8.4.2, in no event shall the Contractor be entitled to any compensation or recovery of any damages in connection with any delay, including, without limitation, consequential damages, lost opportunity costs, impact damages or other similar remuneration. The Contractor hereby expressly waives and covenants and agrees not to assert any claims against the Owner for any damages, costs, losses or expenses of any nature whatsoever which any member of the Construction Team may incur as a result of any delays, interferences, suspensions, rescheduling, changes in sequences, congestion, disruptions, or the like arising from, out of or in connection with any act or omission of the Owner, its representatives or agents, it being understood and agreed that their sole and exclusive remedy in such event shall be an extension of the Contract Time, but only in accordance with the provisions of this Article 8.

8.4.2 In the event of Owner Delay, the Contractor shall be entitled to an equitable adjustment in the Contract Sum. This adjustment shall be based solely upon and limited to additional direct out-of-pocket expenses to the extent they are incurred directly as a result of the Owner Delay. Without limiting the generality of the foregoing, such out-of-pocket expenses shall be calculated on an "actual cost" basis, and shall exclude home office expense and other overhead, profit and the value of lost opportunities. However, the Contractor shall use its best efforts to avoid or reduce delay damages to any member of the Construction Team caused by Owner delay.

## **ARTICLE 9 PAYMENTS AND COMPLETION**

### **§ 9.1 Contract Sum**

**§ 9.1.1** The Contract Sum is stated in the ~~Agreement~~ Contract 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~~ adjusted, unless the Contractor provided such unit prices as part of a competitive bid.

### **§ 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. The initial schedule of values shall be consistent with the Contract Sum prepared by Contractor and shall include actual Subcontractor bids. 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. A request for payment of sums related to Work regarding Construction Change Directives shall, unless qualified in writing at the time of request, constitute full and complete consent to the Construction Change Directive(s) and to the issuance of a Change Order.

**§ 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.

**§ 9.3.1.3** The Contractor shall provide copies of its insurance certificates, bonds, and the same for all Subcontractors prior to submitting the first Application for Payment, unless required to be submitted sooner by the Owner or the Contract. The Contractor shall submit with each monthly Application for Payment (1) an Affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the previous application was submitted and the Owner might in any way be responsible have been paid or otherwise satisfied, and (2) a release or waiver of liens arising out of the Contract from each Contractor and/or Subcontractor, materialmen, supplier and laborer or the Contractor addressing all previous Applications for Payment submitted for the Project.

**§ 9.3.1.4** Retainage: Until Substantial Completion, the Owner shall pay ninety percent (90%) of the amount due the Contractor on account of progress payments.

Init.

§ 9.3.1.5 Each Application for Payment following the initial Application for Payment shall be accompanied by waivers of lien covering, at a minimum, work performed and paid for by Owner in the previous pay application. Progress payments shall be reduced in the amount for which payment was previously made, but no waiver was received.

The Final Payment shall not be made until all data establishing payment or satisfaction of obligations, such as receipts, releases, waivers of lien, claims, security interests or encumbrances arising out the Contract are submitted as required by Owner

**§ 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. Payment to Contractor for materials stored off site is discouraged. When circumstances indicate that the Owner's best interest is served by off-site storage, the Contractor shall make written request to the Owner for approval to include such material costs in his next progress payment. The Contractor's request shall include the following information:

1. A list of the fabricated materials consigned to the Project site (which shall be clearly identified, giving the place of storage, together with copies of invoices and reasons why materials cannot be delivered to the site.
2. Certification that items have been tagged for delivery to the Project and that they will not be used for another purpose.
3. A letter from the Contractor's Surety indicating agreement to the arrangements and that payment to the Contractor shall not relieve either party of their responsibility to complete the Work.
4. Evidence of adequate insurance covering the material in storage, which shall name the Owner as additionally insured.
5. Costs incurred by the Owner and Architect to inspect material in off-site storage shall be paid by the Contractor.
6. Subsequent pay requests shall itemize the materials and their cost which were approved on previous pay requests and remain in off-site storage.
7. When a partial payment is allowed on account of material delivered on the site of the Work or in the vicinity thereof or under possession and control of the Contractor, but not yet incorporated therein, such material shall become the property of the Owner, but if such material is stolen, destroyed or damaged by casualty before being used, the Contractor will be required to replace it at its own expense.

**§ 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.

**§ 9.3.4** Each Application for Payment shall be accompanied by the following, all in form and substance reasonably satisfactory to the Owner:

1. A duly executed and acknowledged sworn statement with all required information provided, together with properly notarized sworn statements, from the Contractor and all of the Subcontractors; and
2. Except as otherwise provided, duly executed unconditional releases in the form required by the Owner establishing payment or satisfaction of all obligations as reflected on the sworn statements referred to in

Init.

/

Section 9.3.4.1, provided, however, that the Contractor may furnish with each Application for Payment applicable waivers of lien or releases and properly notarized sworn statements covering the immediately preceding Application for Payment, as opposed to the current Application for Payment, (i.e., 30 day lag), provided Final Payment shall not be forthcoming until final construction lien waivers or releases from all members of the Construction Team have been delivered.

3. In addition to the final construction lien waiver, the Owner will require the Contractor and Subcontractors to provide a signed and notarized affidavit that releases and discharges the Owner and Owner's agents from all liability to the Contractor and Subcontractor, which has arisen or which shall arise in connection with any work performed or materials delivered to the Project.

#### **§ 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.
- .8 failure to provide any documentation, Record Documents, certified weekly payroll reports, as required, etc., in a timely manner;**
- .9 Any failure by Contractor or a Subcontractor to fully perform any obligation under the Contract;**
- .10 Stop Work notice.**

Init.

§ 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.

§ 9.5.5 If the Contractor disputes any determination by the Owner or Architect with regard to any Certificate for Payment, the Contractor shall nevertheless continue to expeditiously perform the Work and such dispute shall provide no basis for any manner of suspension of the Contractor's performance of the Work.

#### § 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. The Owner may, in its sole discretion, after providing Contractor with ten (10) days prior written notice, make direct payments to the Contractor's Subcontractors, material men, laborers or claimants relating to labor or material provided to the Contractor for which the Contractor has not provided a waiver of lien, in the event the Subcontractors, material men, laborers or claimants threaten to or actually cease providing labor and/or materials for the Project such that, in the Owner's determination, progress of the Project and the Project's schedule are jeopardized. All payments made pursuant to this section shall be considered the same as if paid directly to the Contractor and shall constitute partial payment of the Contract Sum. In the event the Contractor disagrees with the amount proposed to be paid to one or more Subcontractors, material men, laborers or claimants, the Contractor shall provide a bond in the amount the Contractor believes the Owner will overpay, within ten (10) days of receipt of notice, or be barred from making any claim that the amount of the direct payment was incorrect. Payment under this provision shall not jeopardize any other remedy available to the Owner.

§ 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~~

Init.

~~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 otherwise provided in the Contract or Contract Documents, the Owner may retain out of each progress payment a "Retainage" equal to ten percent (10%) of that payment. Retainage will be paid upon Final Completion and acceptance of the Work in accordance with Section 9.10. Upon mutual agreement of the Owner, the Architect and the Contractor, payment in full may be made to subcontractors whose Work is fully completed during early stages of the Project. The Contractor acknowledges and agrees that payments by the Owner shall only be made in respect of Applications for Payments, or portions thereof, reasonably approved by the Owner. If the Contractor disputes any good faith determination by the Owner with regard to any Certificate of Payment, or amount paid by the Owner in respect thereof, the Contractor shall nevertheless expeditiously continue to prosecute the Work while such dispute is being resolved.~~ § 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.

~~§ 9.6.8 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~~ punchlist of items to be completed or corrected prior to final payment. Failure to include an item on such ~~list~~ punchlist 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~~ punchlist, 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~~ punchlist, 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.

**§ 9.8.6** Notwithstanding Sections 9.8.1 and 9.8.2, as a condition precedent to establishing the date of Substantial Completion, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or correct (a "punch list"). The Contractor shall respond immediately to correct Work deficiencies and/or punch list items. Should the Contractor fail to make corrections in a timely fashion, but not later than thirty (30) calendar days from the date of Substantial Completion or notification of the required corrections, whichever is earlier, such Work may be corrected by the Owner at the Contractor's sole expense, and the Contract Sum may be adjusted accordingly.

**§ 9.8.7** Prior to the final payment, Owner shall make a payment equal to the entire balance of the Contract Sum less one hundred fifty percent (150%) of the estimated cost to complete the "punch list" items. This payment shall be due within thirty (30) days after the earlier of (1) receipt of a Temporary or Conditional Certificate of Occupancy for all the Work required under this Agreement from the State of Michigan, (2) completion of Project pursuant to 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 completion of the work, the Contractor shall provide to the Architect a written 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,

Init.

(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~~ actual 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.
- .5 Owner's Claims arising after final payment;
- .6 Owner's claims for indemnification; or
- .7 Claims about which the Owner has previously given notice to the Contractor

§ 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.

§ 9.10.6 The amount of the final Payment shall be the Contract Sum less the amount paid to date. If the aggregate of previous payments made by the Owner exceeds the amount due the Contractor, the Contractor shall immediately reimburse the difference to the Owner.

## 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. continuously maintain adequate protection of all Work from damage and shall protect the Owner's property from injury or loss. The Contractor shall repair any such damage, injury or loss at no cost to the Owner, except to the extent directly caused by agents or employees of the Owner. The Contractor shall adequately protect the Work and adjacent property as required by Applicable Laws, the Contract Documents, or as otherwise required, to cause no damage to the Work and adjacent property during the execution of the Work. This requirement shall also apply to structures above and below ground as conditions of the Work site require. The Contractor shall at all times observe and comply with all Applicable Laws which may in any manner affect the equipment and materials used in the proposed construction, those employed on the work, and the conduct of the Work. The Contractor shall hold harmless and indemnify the Owner and its Board (in its individual and official capacities), employees and administrators, against any claim or liability arising from the violation of any Applicable Laws, whether the violations are by the Contractor or any Subcontractor, Sub-subcontractor or any other person employed or engaged by the Contractor or Subcontractor.

§ 10.1.1 The Contractor is solely responsible to the Owner for health and safety at the Project site and, accordingly, shall be solely responsible for initiating, monitoring, maintaining and supervising all safety precautions and programs in connection with the performance of the Work. The foregoing does not relieve the Subcontractors of their responsibility to the Contractor for the safe performance of their Work in accordance with all Applicable Laws.

Init.

§ 10.1.2 The Contractor shall develop and implement a health and safety plan that complies with all Applicable Laws covering all activities on the Project site except those activities performed solely by the Owner. The Contractor shall provide the Owner a copy of such health and safety plan prior to commencement of Work. The Owner shall have no duty to review the plan and shall assume no duty by doing so.

## **§ 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~~ No use or storage of explosives or other hazardous materials or unusual methods shall be allowed at the Project site without the Owner's express written consent. If use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary permitted by the Owner for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel. ~~personnel,~~ and shall store and use in compliance with all Applicable Laws.

**§ 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. he Contractor shall take all necessary precautions for the safety of employees and visitors on the Project site and shall comply with Applicable Laws and provisions of federal, state, and municipal safety laws and building codes to prevent accidents or injury to persons on, about or adjacent to the Project Site where the Work is being performed. The Contractor shall erect and properly maintain at all times, as required by the conditions and progress of the Work, all necessary safeguards for the protection of workers

Init.

and the public. The Contractor shall post danger signs warning against the hazards created by such features of construction such as protruding nails, hoists, holes, elevator hatchways, scaffolding, window openings, stairways, falling material and other such features.

§ 10.2.9 When all or a portion of the Work is suspended for any reason, the Contractor shall be responsible for securely fastening down all coverings and protecting the Work from injury by any cause.

§ 10.2.10 The Contractor shall promptly report in writing to the Owner all accidents arising out of or in connection with the Work which cause death, personal injury, or property damage, giving full details and statements of any witnesses. In addition, if death, serious personal injuries, or serious property damages occur, the accident shall be reported immediately by telephone or messenger to the Owner. The obligations in this Section are in addition to the Contractor's reporting obligations under Applicable Laws.

### **§ 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 report the condition to the Owner and Architect in writing.~~ The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify  report the condition to the Owner and Architect of the condition, in writing.

**§ 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. Contractor shall not permit itself or any third party to use, generate, handle, store or dispose of any Hazardous Materials in, on, under, upon or affecting any of the Owner's property in violation of any Applicable Laws or regulation. Without limiting any other provisions of the Contract Documents, Contractor shall indemnify, defend and hold harmless the Owner, its Board of Education, its Board Members in their official and individual capacities, administrators, employees, agents, contractors, successors and assignees, from and against all liabilities, claims, losses, costs and expenses (specifically including, without limitation, attorneys', engineers', consultants' and experts' fees, costs and expenses) arising from (1) any breach of any representation or warranty made in this paragraph and/or (2) environmental conditions or noncompliance with any Applicable Laws or regulation that result, in the case of Contractor, from operations or the Work by Contractor or its agents, employees or Subcontractors. As used herein, the term "Hazardous Materials" shall mean (1) any hazardous or regulated substance, pollutant, contaminant, material, or waste as defined by any federal, state and local environmental laws, or regulations promulgated thereunder, including, but not limited to, Federal Water Pollution Control Act (33 U.S.C. §§ 1251 et seq.) ("Clean Water Act") the Resource Conservation & Recovery Act (42 U.S.C. §§ 6901 et seq.) ("RCRA"), Safe Drinking Water Act (42 U.S.C. §§ 300f-j-26 et seq.) (Toxic Substances Control Act (14 U.S.C. §§ 2601 et seq.) (Clean Air Act 42 U.S.C. §§ 7401 et seq.), the Comprehensive Environmental Response, Compensation and Liability Act (42 U.S.C. §§ 9601 et seq.) ("CERCLA"), the Emergency Planning and Community Right to Know Act, 42 U.S.C. §§ 11001 et seq.) ("EPCRA"), the Atomic Energy Act, 42 U.S.C. Sections 2014, et seq., and the Michigan Natural Resources and Environmental Protection Act (MCL§ 324.101 et seq.) or any other similar federal, state or local law or administrative rule or regulation of similar effect, each as amended and as in effect and as adopted as of the date of execution of this Contract, or date of Work, whichever is more protective of the Owner. (2) any other pollutant, contaminant, hazardous~~

substance, solid waste, hazardous material, radioactive substance, toxic substance, noxious substance, hazardous waste, particulate matter, airborne or otherwise, chemical waste, medical waste, crude oil or any fraction thereof, radioactive waste, petroleum or petroleum-derived substance or waste, asbestos, PCBs, radon gas, all forms of natural gas, or any hazardous or toxic constituent of any of the foregoing, whether such substance is in liquid, solid or gaseous form, or (3) any such substance the release discharge or spill of which requires activity to achieve compliance with Applicable Law. This paragraph shall survive the expiration or earlier termination of the Contract.

~~§ 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. The Owner shall not be responsible for any substances or Hazardous Materials which Contractor, its agents, employees or Subcontractors bring into the Project site, or Owner's property.~~

~~§ 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-Contract~~ 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-Contract~~ 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. A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the Contractor, Subcontractor and suppliers, as their interests may appear. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.~~

§ 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

Init.

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. The Owner as fiduciary shall have the power to adjust and settle a loss with insurers.~~

**§ 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 request, with the Owner's written consent,~~ 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

Init.

Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor ~~shall~~ shall, without interfering with Owner's operations, 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. The obligation shall survive the termination of the contract.

§ 12.2.2 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.

§ 12.2.3 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.

### § 12.4 Owner's Right to Correct or Remove Defective Work

§ 12.4.1 If the Contractor fails to cause defective Work to be corrected within a reasonable time after receipt of notice from the Owner, the Owner may correct it and the Contractor shall pay the Owner all costs of correction (including the value of the Owner's staff time) upon demand. Alternatively, in the event of such failure, the Owner may (without being deemed a bailee) remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten (10) days after written notice, the Owner may upon ten (10) additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting from the sale proceeds all costs, expenses and damages that should have been borne by the Contractor (including the value of the Owner's staff time and reasonable attorneys' fees). If the proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency, plus interest. If payments then or thereafter due the Contractor are not sufficient to cover the amount owed, the Contractor shall pay the difference to the Owner immediately upon demand.

§ 12.4.2 The Owner's right to store and sell such defective Work shall not give rise to a duty to do so. Instead, the Owner may upon ten (10) day's prior written notice simply dispose of such defective Work as it sees fit. All costs of disposal shall be borne by the Contractor, without recovery from the Owner, under the Contract Sum, any contingency or otherwise.

§ 12.4.3 Tests. If tests or inspections reveal that portions of the Work are Defective, any additional tests or inspections required to assure the Architect and the Owner that the defective Work has been remedied or is in an acceptable condition shall be conducted at the expense of the Contractor, without increase in the Contract Sum, and without use of

Init.



any contingency. The Contractor shall pay all additional costs of the Architect and the Owner, which are associated with such additional tests or inspections.

§ 12.4.4 Periods of Limitation. Nothing contained in this Article 12 shall be construed to establish a period of limitation with respect to other obligations, which the Contractor might have under the Contract Documents or Applicable Laws. Establishment of the Correction Period relates only to the specific obligation of the Contractor to correct the Work under this Article 12 and has no relationship to the time within which the obligation to comply with the Contract may be sought to be enforced by the Owner, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to its obligations under the Contract.

§ 12.4.5 The Owner's Right to Stop the Work. If the Contractor fails to correct Work, which is not in accordance with the requirements of the Contract Documents as required by Section 12.2.2 or fails to carry out the Work in accordance with the Contract Documents, the Owner may, by written order, direct 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.

#### §12.5 Damage

§ 12.5.1 If prior to the date of Final Completion any member of the Construction Team uses or damages any portion of the Work or other property, including, without limitation, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner, without recovery from the Owner, under the Contract Sum, any contingency or otherwise, unless such damage is caused by the Owner or Architect.

§ 12.5.2 The Contractor shall bear the cost of correcting destroyed or damaged construction or other property, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

§ 12.5.3 Nothing in this Section 12.5 either limits the parties' rights to obtain recovery from any applicable property insurance or entitles the insurer to pursue a subrogation claim.

### **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.~~ located.

#### **§ 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.~~ third party. 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.

Init.

## § 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:

- .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.

Init.

**§ 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.~~ executed.

~~**§ 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.
- .5 the Contractor fails to prosecute the Work or any part thereof with promptness and diligence or fails to perform any provisions of this Contract, or goes into bankruptcy, liquidation, makes an assignment for the benefit of creditors, enters into a composition with its creditors, or becomes insolvent.**

**§ 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.

In the event the Contractor's surety bond requires notice of intent to declare a default of the Contractor and if such bond notice is provided by the Owner, such notice shall be adequate to satisfy the three (3) day written notice described above in this section.

**§ 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 in pursuing termination and completion of the Work, including actual attorney and legal fees and costs 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, executed as of the date of termination by Owner and subject to negotiation by both parties.~~

### 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. Failure to provide such notice shall serve as an absolute bar against a claim for such an increase in the Contract Sum. 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-Contract~~. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to ~~mediation-litigation or any other mutually agreed upon dispute resolution forum~~ 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

Init.

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.~~both

**§ 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. 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.~~

**§ 15.2.6.1** ~~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

Init.

/

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.

## **Certification of Document's Authenticity**

**AIA® Document D401™ – 2003**

I, \_\_\_\_\_, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with this certification at 13:50:42 ET on 03/20/2023 under Order No. 2114348013 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A201™ – 2017, General Conditions of the Contract for Construction, other than changes shown in the attached final document by underscoring added text and striking over deleted text.

---

*(Signed)*

---

*(Title)*

---

*(Dated)*



## SECTION 01 1000 SUMMARY

### PART 1 GENERAL

#### 1.01 PROJECT

- A. Project Name: Crestwood High School Field Buildings
- B. Owner's Name: Crestwood School District.
- C. Architect's Name: Ehresman Architects.
- D. Additional Project contact information is specified in Section 00 0103 - Project Directory.
- E. The Project consists of remodeling and new construction of Field Buildings at Crestwood High School.

#### 1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in AIA Document A701-2018 "Instructions to Bidders".

#### 1.03 DESCRIPTION OF ALTERATIONS WORK

- A. Scope of alterations work is indicated on drawings.
- B. The work generally consists of:
  - 1. Removal.
    - a. Existing Cell Tower/Storage (Building A) – Removal of existing site paving, topsoil, fill material for construction of brick ledge foundation and building addition, exterior siding (evaluate condition of exterior sheathing), doors, frames & hardware, exterior mechanical and electrical as indicated on drawings. No interior work beyond replacement of exterior doors..
    - b. Existing Concessions/Storage (Building B) – Removal of existing site paving, topsoil, fill material for construction of brick ledge foundation, interior framing, ceilings, casework, doors, frames & hardware, mechanical and electrical as indicated on drawings..
  - 2. New Work.
    - a. Home Field Building/Concessions (Building A) – Sitework, perimeter foundations for existing building brick ledge and door stoops, building addition foundations, face brick of existing building, masonry building addition, wood trusses, asphalt shingle roof (including existing), doors, frames & hardware, windows, food service equipment, restroom partitions and accessories, mechanical, plumbing, electrical as indicated on drawings.
    - b. Visitor Field Building (Building B) – Sitework, perimeter foundations for existing building brick ledge and door stoops, face brick of existing building, new masonry interior walls, roof overhang rework, asphalt shingle roof, doors, frames & hardware, restroom partitions and accessories, mechanical, plumbing, electrical as indicated on drawings.
- C. Owner will remove the following items before start of work:
  - 1. Moveable athletic equipment.
  - 2. Moveable concessions equipment.

#### 1.04 WORK BY OTHERS

- A. Adjacent construction for the athletic field site improvements will be ongoing during the duration of this project. Communication and coordination will be necessary.

#### 1.05 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the site during the entire construction period.

- B. Owner intends to occupy the area of work upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

#### **1.06 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations:
  - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site and premises to allow:
  - 1. Owner occupancy.
- C. Provide access to and from site as required by law and by Owner:
  - 1. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Time Restrictions:
  - 1. Limit conduct of especially noisy exterior work to the hours of 7:00 a.m. to 7:00 p.m..
  - 2. The Contractor may execute the work during the entire twenty-four (24) hours of any day of the week with the approval of the Owner, provided that they so conduct their operations as to not create a public nuisances or disturb the peace, and provide such operations are conducted so as to comply with all applicable laws, ordinances, and regulations and that building security needs are provided.
  - 3. Whenever a Contractor intends to depart from normal work hours, they shall notify the Owner in writing at least forty-eight (48) hours in advance. Special arrangements can be made for emergency work or shutdowns as may be required.
  - 4. If work is not completed by the start of the school in September, excessively noisy work must be performed after school hours.
- E. Utility Outages and Shutdown:
  - 1. Limit disruption of utility services to hours the site is unoccupied.
  - 2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
  - 3. Prevent accidental disruption of utility services to other facilities.
- F. Employee Appearance and Behavior
  - 1. Sleeved shirts and long pants are required minimum clothing.
  - 2. Criminal background check may be undertaken by the owner. A felony conviction may likely cause removal of that individual this job site.
  - 3. Radios are not permitted during times the owner occupies the building.
  - 4. The following are strictly prohibited:
    - a. Possession or consumption of narcotics or intoxicants.
    - b. Smoking anywhere on the Owner's property.
    - c. Conduct that interferes with work or work of others.
    - d. Conduct that interferes with or is detrimental to good safety and well-being.
    - e. Vulgar language, threats, leering, whistling, sexual harassment, racial remarks or discrimination toward building occupants or the public.
    - f. Unauthorized use of confidential information.
    - g. Falsification of information.
    - h. Canvassing, soliciting, posting, or distributing literature or materials for any purpose while on the job site.
    - i. Disregard of safety, sanitation, or security regulations or requirements.
    - j. Conduct detrimental to the owner's operations and good reputation.
    - k. Stealing.
    - l. Gambling.
    - m. Disorderly conduct or fighting.
    - n. Possession of guns, knives or other weapons.

**1.07 WORK SEQUENCE**

- A. Coordinate construction schedule and operations with Owner and Architect.

**1.08 SPECIFICATION SECTIONS APPLICABLE TO EVERY CONTRACT**

- A. Unless otherwise noted, provisions of the sections listed below apply to every contract.  
Specific items of work listed under individual contract descriptions constitute exceptions.
- B. Section 00 0103 - Project Directory.
- C. Section 01 2000 - Price and Payment Procedures.
- D. Section 01 2200 - Unit Prices.
- E. Section 01 2300 - Alternates.
- F. Section 01 2500 - Substitution Procedures.
- G. Section 01 3000 - Administrative Requirements.
- H. Section 01 4000 - Quality Requirements.
- I. Section 01 5000 - Temporary Facilities and Controls.
- J. Section 01 6000 - Product Requirements.
- K. Section 01 7000 - Execution and Closeout Requirements.
- L. Section 01 7800 - Closeout Submittals.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

This page intentionally left blank

**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 RELATED REQUIREMENTS**

- A. AIA A101-2017 "Standard Form of Agreement Between Owner & Contractor"
- B. AIA A101-2017 Exhibit A "Insurance Bonds"
- C. AIA Document A201-2007 "General Conditions of the Contract for Construction"
- D. Section 01 7800 - Closeout Submittals: Project record documents.

**1.03 SCHEDULE OF VALUES**

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.
- D. 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 close out documents.
  - 1. Include at a minimum 5% of the contract sum, for close-out documents (as built documents, training and O&M manuals, attic stock materials, warranty and guarantee documents, and punch list completion).
- E. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- F. Revise schedule to list approved Change Orders, with each Application For Payment.

**1.04 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. Forms filled out by hand will not be accepted.
- D. 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.
- E. Execute certification by signature of authorized officer.

- F. 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.
- G. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- H. Submit one electronic copy of each Application for Payment. Hard copies to be provided on request.
- I. 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. Current construction photographs specified in Section 01 3000.
  - 4. Waivers of Lien shall be provided in the following forms:
    - a. Conditional Waiver on Progress Payment – Prime contractor to supply this waiver in the full amount requested on each application for payment.
    - b. Unconditional Waiver on Progress Payment – Prime Contractor and Subcontractors are to supply this waiver after receiving each progress payment.
    - c. Conditional Waiver on Final Payment – Prime contractor to supply this waiver in the full amount requested on the final application for payment.
    - d. Unconditional Waiver on Final Payment – Prime Contractor and Subcontractors are to supply this waiver after receiving final payment for the project.
  - 5. Waiver Checklist: Shall be submitted with each Application for Payment, to clearly identify the list of waivers required and the amount that each is to be for. Refer to the form at the end of this specification section for a sample.
  - 6. Affidavits attesting to off-site stored products.
- J. 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.

#### **1.05 MODIFICATION PROCEDURES**

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- C. 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.
- D. 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 the length of time specified based on the extent of the work.
- E. 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.
- F. 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.
- G. 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. 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.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. 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.
- J. 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.
- K. Promptly enter changes in Project Record Documents.

#### **1.06 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:
  1. All closeout procedures specified in Section 01 7000.
  2. AIA Document G706-1994 "Contractor's Affidavit of Payment of Debts and Claims".
  3. AIA Document G706A-1994 " Contractor's Affidavit of Release of Liens".

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

This page intentionally left blank





This page intentionally left blank

**SECTION 01 2100  
ALLOWANCES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Contingency allowance.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

**1.03 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.

**1.04 ALLOWANCES SCHEDULE**

- A. Metal-Plate-Connected Trace Bracing Allowance: Include the stipulated sum/price of \$500 to provide wood truss bracing..

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

This page intentionally left blank

**SECTION 01 2200  
UNIT PRICES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. List of unit prices, for use in preparing Bids.

**1.02 RELATED REQUIREMENTS**

- A. Document 00 4322 - Unit Prices Form: List of Unit Prices as supplement to Bid Form
- B. Section 01 2000 - Price and Payment Procedures: Additional payment and modification procedures.

**1.03 COSTS INCLUDED**

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, transportation, services and incidentals; overhead and profit.

**1.04 UNIT QUANTITIES SPECIFIED**

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

**1.05 MEASUREMENT OF QUANTITIES**

- A. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect.
- B. Assist by providing necessary equipment, workers, and survey personnel as required.

**1.06 PAYMENT**

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Architect, multiplied by the unit price.

**1.07 DEFECT ASSESSMENT**

- A. Replace Work, or portions of the Work, not complying with specified requirements.
- B. The authority of Architect to assess the defect and identify payment adjustment is final.

**1.08 SCHEDULE OF UNIT PRICES**

- A. Additional Foundation Excavation.
  - 1. To remove excess foundations soils from site and dispose of same, beyond the limits stated in the document when caused by concealed conditions, other than described in the documents.
    - a. Provide cost per cubic yard (trucking volume) 1 to 20 cy.
    - b. Provide cost per cubic yard (trucking volume) over 21 cy.
- B. Additional Mass Gradomg Excavation.
  - 1. To remove excess unsuitable soil under floor slabs or parking lots from the site and dispose of same, when caused by concealed conditions, other than described in the documents.
    - a. Provide cost per cubic yard (trucking volume) over 21 cy.
- C. Additional Undercut Fill Material
  - 1. To add MDOT 6AA with MDOT 21AA choke layer per Figure 2: Typical Undercutting Diagram on page 12 of the Geotechnical Report.
    - a. Provide cost per cubic yard (trucking volume).
- D. Additional Compacted Sand Fill.
  - 1. To add Class II sand fill delivered, placed and compacted if caused by concealed conditions other than described in the documents.

- a. Provide cost per cubic yard (trucking volume).
- E. Add Foundation Concrete.
  - 1. To add foundation concrete reinforced per detail x/xx.
    - a. Provide cost per cubic yard.
- F. Remove Concealed Foundations (if encountered).
  - 1. Remove 4' long section of 12" wide masonry or concrete basement wall to a depth of 2' below bottom of new footing and dispose off-site.
    - a. Provide cost per each 4' long section removed.
- G. Add Additional Data Location.
  - 1. Add conduit with pull string and blank box for additional data location.
    - a. Provide cost per each location.
- H. Add 3/4" Plywood Wall Sheathing
  - 1. Replacement of existing damaged plywood sheathing.
    - a. Provide cost per 4 x 8 sheet.
- I. Add 3/4" Plywood Roof Sheathing
  - 1. Replacement of existing damaged plywood sheathing.
    - a. Provide cost per 4 x 8 sheet.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 2300  
ALTERNATES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description of Alternates.

**1.02 RELATED REQUIREMENTS**

- A. Document 00 4323 - Alternates Form: List of Alternates as supplement to Bid Form.

**1.03 ACCEPTANCE OF ALTERNATES**

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

**1.04 SCHEDULE OF ALTERNATES**

**BUILDING A:**

- A. Alternate No. 1 - Food Service Equipment:
  - 1. Alternate Item: ADD to the base proposal amount to purchase and install Food Service Equipment. Refer to the drawings and Section 11 4011 for further information. Include itemized breakdown on page 12 and 13 of Section 11 4011.
- B. Alternate No. 2 - Stadium Entry with Masonry Piers, Ticket Booth, Decorative Gates and Arch:
  - 1. Alternate Item: ADD to the base proposal amount to install Masonry Piers, Ticket Booth, Decorative Gates and Arch. Refer to the drawings for further information.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

This page intentionally left blank



## **SECTION 01 2500 SUBSTITUTION PROCEDURES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 2200 - Unit Prices, for additional unit price requirements.
- B. Section 01 2300 - Alternates, for product alternatives affecting this section.
- C. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.
- D. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

#### **1.03 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.

#### **1.04 REFERENCE STANDARDS**

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage) Current Edition.
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase) Current Edition.

### **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:
  - 1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
  - 1. Note explicitly any non-compliant characteristics.
- D. 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. Submittal Form (before award of contract):
  - 1. Submit substitution requests by completing the form attached to this section. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Owner will consider requests for substitutions only if submitted at least 7 days prior to the date for receipt of bids.

### **3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Submittal Form (after award of contract):
  - 1. Submit substitution requests by completing the form attached to this section. See this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.
- B. Architect will consider requests for substitutions only within 15 days after date of Agreement.
- C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
  - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
  - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
  - 3. Bear the costs engendered by proposed substitution of:
    - a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.
    - b. Other construction by Owner.
    - c. Other unanticipated project considerations.
- E. Substitutions will not be considered under one or more of the following circumstances:
  - 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
  - 2. Without a separate written request.
  - 3. When acceptance will require revisions to Contract Documents.

### **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.
  - 1. Architect's decision following review of proposed substitution will be noted on the submitted form.

**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.

**3.06 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
- B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

**3.07 ATTACHMENTS**

- A. CSI / CSC Form 1.5C.
- B. CSI / CSC Form 13.1A.

**END OF SECTION**

This page intentionally left blank



# SUBSTITUTION REQUEST

(During the Bidding/Negotiating Stage)

Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
 \_\_\_\_\_  
 From: \_\_\_\_\_  
 To: \_\_\_\_\_ Date: \_\_\_\_\_  
 \_\_\_\_\_  
 A/E Project Number: \_\_\_\_\_  
 Re: \_\_\_\_\_ Contract For: \_\_\_\_\_

Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_  
 Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

Proposed Substitution: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Trade Name: \_\_\_\_\_ Model No.: \_\_\_\_\_

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

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

The Undersigned certifies:

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

Submitted by: \_\_\_\_\_  
 Signed by: \_\_\_\_\_  
 Firm: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Telephone: \_\_\_\_\_

### A/E's REVIEW AND ACTION

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

Signed by: \_\_\_\_\_ Date: \_\_\_\_\_

Supporting Data Attached:  Drawings  Product Data  Samples  Tests  Reports  \_\_\_\_\_

This page intentionally left blank



# SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
 \_\_\_\_\_  
 From: \_\_\_\_\_  
 To: \_\_\_\_\_ Date: \_\_\_\_\_  
 \_\_\_\_\_  
 A/E Project Number: \_\_\_\_\_  
 Re: \_\_\_\_\_ Contract For: \_\_\_\_\_

Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_  
 Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

Proposed Substitution: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Trade Name: \_\_\_\_\_ Model No.: \_\_\_\_\_  
 Installer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_

History:  New product  1-4 years old  5-10 years old  More than 10 years old

Differences between proposed substitution and specified product: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item: \_\_\_\_\_  
 \_\_\_\_\_

### Similar Installation:

Project: \_\_\_\_\_ Architect: \_\_\_\_\_  
 Address: \_\_\_\_\_ Owner: \_\_\_\_\_  
 \_\_\_\_\_ Date Installed: \_\_\_\_\_

Proposed substitution affects other parts of Work:  No  Yes; explain \_\_\_\_\_  
 \_\_\_\_\_

Savings to Owner for accepting substitution: \_\_\_\_\_ (\$ \_\_\_\_\_).

Proposed substitution changes Contract Time:  No  Yes [Add] [Deduct] \_\_\_\_\_ days.

Supporting Data Attached:  Drawings  Product Data  Samples  Tests  Reports  \_\_\_\_\_

This page intentionally left blank



# SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase — Continued)

---

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
  - Same warranty will be furnished for proposed substitution as for specified product.
  - Same maintenance service and source of replacement parts, as applicable, is available.
  - Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
  - Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
  - Proposed substitution does not affect dimensions and functional clearances.
  - Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
  - Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.
- 

Submitted by: \_\_\_\_\_

Signed by: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Telephone: \_\_\_\_\_

Attachments:

---

## A/E's REVIEW AND RECOMMENDATION

- Approve Substitution - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- Approve Substitution as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures.
- Reject Substitution - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: \_\_\_\_\_ Date: \_\_\_\_\_

---

## OWNER'S REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01 33 00 Submittal Procedures. Prepare Change Order.
- Substitution rejected - Use specified materials.

Signed by: \_\_\_\_\_ Date: \_\_\_\_\_

---

Additional Comments:     Contractor     Subcontractor     Supplier     Manufacturer     A/E

This page intentionally left blank

**SECTION 01 3000  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Weekly Contractor Long Lead Item Checklist.
- F. Contractor's daily reports.
- G. Progress photographs.
- H. Submittals for review and project closeout.
- I. Number of copies of submittals.
- J. Requests for Information (RFI) procedures.
- K. Submittal procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6000 - Product Requirements: General product requirements.
- B. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.
- C. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

**1.03 REFERENCE STANDARDS**

- A. AIA G716 - Request for Information 2004.
- B. AIA G810 - Transmittal Letter 2001.

**1.04 GENERAL ADMINISTRATIVE REQUIREMENTS**

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
  - 1. Requests for Information (RFI).
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.
  - 9. Weekly Contractor Long Lead Item Checklist.
  - 10. Coordination drawings.
  - 11. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 12. Closeout submittals.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 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. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
  - 4. Submission of initial Submittal schedule.
  - 5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 6. Scheduling.
- D. Record minutes, share with Architect for approval, and then after approval distribute copies via email within four days after meeting to participants, and those affected by decisions made.

### **3.02 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.
- 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. Review of RFIs log and status of responses.
  - 7. Review of off-site fabrication and delivery schedules.
  - 8. Maintenance of progress schedule.
  - 9. Corrective measures to regain projected schedules.
  - 10. Planned progress during succeeding work period.
  - 11. Coordination of projected progress.
  - 12. Maintenance of quality and work standards.
  - 13. Effect of proposed changes on progress schedule and coordination.
  - 14. Other business relating to work.
- E. Record minutes, share with Architect for approval, and then after approval distribute copies via email within one week after meeting to participants, and those affected by decisions made.

### **3.03 CONSTRUCTION PROGRESS SCHEDULE**

- A. Within 10 days after date of the 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.

### **3.04 WEEKLY CONTRACTOR LONG LEAD ITEM CHECKLIST**

- A. Within 10 days after date of the Agreement, submit preliminary long lead item checklist detailing anticipated long lead items and their delivery dates.
- B. If preliminary list requires revisions after review, submit revised schedule within 10 days.
- C. Submit updated schedule each week on Monday.

### **3.05 DAILY CONSTRUCTION REPORTS**

- A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.
- B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:
  1. Date.
  2. High and low temperatures, and general weather conditions.
  3. List of subcontractors at Project site.
  4. List of separate contractors at Project site.
  5. Approximate count of personnel at Project site.
    - a. Include a breakdown for supervisors, laborers, journeymen, equipment operators, and helpers.
  6. Major equipment at Project site.
  7. Material deliveries.
  8. Safety, environmental, or industrial relations incidents.
  9. Meetings and significant decisions.
  10. Unusual events (submit a separate special report).
  11. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
  12. Meter readings and similar recordings.
  13. Emergency procedures.
  14. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
  15. Change Orders received and implemented.
  16. Testing and/or inspections performed.
  17. List of verbal instruction given by Owner and/or Architect.
  18. Signature of Contractor's authorized representative.

### **3.06 PROGRESS PHOTOGRAPHS**

- A. Submit new photographs at least once a week, within 3 days after being taken.
- B. Photography Type: Digital; electronic files.
- C. Take photographs as evidence of existing project conditions as follows:
  1. Exterior views.
- D. Views:
  1. Consult with Architect for instructions on views required.
  2. Provide factual presentation.
  3. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

- E. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
  - 1. Delivery Medium: Via email.
  - 2. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

### 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. 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. Combine RFI and its attachments into a single electronic file. PDF format is preferred.
  - 3. Send RFIs to **submittals@ehresmanarchitects.com**.
- C. 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).
- D. 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.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
  - 1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  - 2. Note dates of when each request is made, and when a response is received.
  - 3. Highlight items requiring priority or expedited response.
  - 4. Highlight items for which a timely response has not been received to date.
- G. 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.
- H. 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 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
  - 1. Coordinate with Contractor's construction schedule and schedule of values.
  - 2. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
  - 3. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    - a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

### **3.09 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. Submit Correction Punch List for Substantial Completion.
- B. Submit Final Correction Punch List for Substantial Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.

### **3.10 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.
- B. Extra Copies at Project Closeout: See Section 01 7800.

- C. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. Retained samples will not be returned to Contractor unless specifically so stated.

### 3.11 SUBMITTAL PROCEDURES

- A. General Requirements:

1. Use a separate transmittal for each item.
2. Submit separate packages of submittals for review and submittals for information, when included in the same specification section.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. 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.
6. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
  - a. Deliver physical samples to Architect at business address.
  - b. Send submittals in electronic format via email to Architect at **submittals@ehresmanarchitects.com**.
7. 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.
  - c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.
8. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
9. Provide space for Contractor and Architect review stamps.
10. When revised for resubmission, identify all changes made since previous submission.
11. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
12. 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.

- B. 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. This is information should be turned over to the Owner for maintenance and record purposes.

- C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Upon request, Architect will provide a CAD Waiver for Sub-Contractor review and signature. Once completed Waiver is received, Architect will provide CAD Background File for shop drawing use.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.



- D. 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. Include with transmittal high-resolution image files of samples to facilitate electronic review and approval. Provide separate submittal page for each item image.

### **3.12 SUBMITTAL REVIEW**

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. 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.
- D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
    - a. "Reviewed - No Exceptions Taken", or language with same legal meaning.
    - b. "Reviewed - Note Exceptions", or language with same legal meaning.
      - 1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
  2. Not Authorizing fabrication, delivery, and installation:
    - a. "Revise and Resubmit".
      - 1) Resubmit revised item, with review notations acknowledged and incorporated.
      - 2) Non-responsive resubmittals may be rejected.
    - b. "Rejected".
      - 1) Submit item complying with requirements of Contract Documents.
- E. Architect's and consultants' actions on items submitted for information:
1. Items for which no action was taken:
    - a. "Not Reviewed; Record Purposes Only" - to notify the Contractor that the submittal has been received for record only.

**END OF SECTION**

This page intentionally left blank



This page intentionally left blank

## **SECTION 01 4000 QUALITY REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's design-related professional design services.
- F. Control of installation.
- G. Tolerances.
- H. Manufacturers' field services.
- I. Defect Assessment.

#### **1.02 RELATED REQUIREMENTS**

- A. Document 00 3100 - Available Project Information: Soil investigation data. Abestos and Lead Reports to be provided after contract award.
- B. Section 01 3000 - Administrative Requirements: Submittal procedures.
- C. Section 01 6000 - Product Requirements: Requirements for material and product quality.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants 2008 (Reapproved 2019).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation 2017.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry 2022a.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction 2019.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection 2021.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing 2021.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components 2016.
- H. IAS AC89 - Accreditation Criteria for Testing Laboratories 2021.

#### **1.04 DEFINITIONS**

- A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.
- B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
  - 1. Design Services Types Required:
    - a. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

- C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Test Reports: After each test/inspection, promptly email copies of report to Architect and to Contractor.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Compliance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.
  - 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

#### **1.06 QUALITY ASSURANCE**

#### **1.07 REFERENCES AND STANDARDS**

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

#### **1.08 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.

## **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 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 Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### **3.03 TESTING AND INSPECTION**

- A. See individual specification sections for testing and inspection required.
- B. Testing Agency Duties:
  - 1. Provide qualified personnel at site. Cooperate with Architect and 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 Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 5. Perform additional tests and inspections required by Architect.
  - 6. Submit reports of all tests/inspections specified.
- C. 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 Contractor.
  - 4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
  - 1. Cooperate with laboratory personnel, and provide access to the Work.
  - 2. 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.
- 3. Notify laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
- 4. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

#### **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 equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect 30 days in advance of required observations.
  - 1. Observer subject to approval of Architect.
  - 2. Observer subject to approval of Owner.
- C. 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 complying with specified requirements.

**END OF SECTION**



**SECTION 01 4100  
REGULATORY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SUMMARY OF REFERENCE STANDARDS**

- A. Regulatory requirements applicable to this project are the following:
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- D. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. Michigan Building Code 2015 Edition.
- F. Erosion and Sedimentation Control Regulations:.
- G. Michigan School Fire Safety Rules 2012 Edition.
- H. Michigan Plumbing Code 2018 Edition.
- I. Michigan Mechanical Code 2015 Edition.
- J. National Electric Code (with Michigan Part 8 Rules) 2017 Edition.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 4000 - Quality Requirements.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

This page intentionally left blank

**SECTION 01 5000  
TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Dewatering
- B. Temporary utilities.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Field offices.

**1.02 DEWATERING**

- A. Provide temporary means and methods for dewatering all temporary facilities and controls.

**1.03 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power, consisting of connection to existing facilities.
  - 2. Water supply, consisting of connection to existing facilities.

**1.04 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.
- C. At end of construction, return facilities to same or better condition as originally found.

**1.05 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 existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide protection for plants designated to remain. Replace damaged plants.

**1.06 FENCING**

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

**1.07 SECURITY**

- A. Contractor to properly secure work site and materials to protect Work, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Coordinate with Owner's security program.

**1.08 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 Owner.
- C. Signs, Signals, and Devices
  - 1. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
  - 2. Flag Person Equipment: As required by local jurisdictions.

- D. Provide and maintain access to fire hydrants, free of obstructions.
- E. Provide means of removing mud from vehicle wheels before entering streets.
- F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- G. Existing parking areas may be used for construction parking when coordinated with Owner.
- H. Flag Persons
  - 1. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

#### **1.09 WASTE REMOVAL**

- A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.
- B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- C. Provide containers with lids. Remove trash from site periodically.
- D. 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.

#### **1.10 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.

#### **1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.
- D. Restore new permanent facilities used during construction to specified condition.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## **SECTION 01 5100 TEMPORARY UTILITIES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 5000 - Temporary Facilities and Controls:
  - 1. Temporary sanitary facilities required by law.

#### **1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

#### **1.04 TEMPORARY ELECTRICITY**

- A. Connect to Owner's existing power service.
  - 1. Do not disrupt Owner's need for continuous service.
  - 2. Exercise measures to conserve energy.
- B. Provide temporary electric feeder from existing building electrical service at location as directed.
- C. Complement existing power service capacity and characteristics as required.
- D. Permanent convenience receptacles may be utilized during construction.
- E. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

#### **1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES**

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.

#### **1.06 TEMPORARY HEATING**

- A. Cost of Energy: By Contractor.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

#### **1.07 TEMPORARY VENTILATION**

- A. Provide ventilation to prevent hazardous accumulations of dusts, fumes, mists, vapors, or gases in areas occupied during construction. Maintain, and remove when no longer required.
- B. Dispose of exhaust materials in a manner that will not result in harmful exposure to persons or materials.
- C. Ventilate storage spaces containing hazardous or volatile materials. Provide adequate ventilation for curing installed materials, dispersal of humidity, and ventilation of temporary sanitary facilities.

**1.08 TEMPORARY WATER SERVICE**

- A. Cost of Water Used: By Owner.
- B. Connect to existing water source.
  - 1. Exercise measures to conserve water.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

## **SECTION 01 6000 PRODUCT REQUIREMENTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Maintenance materials, including extra materials, spare parts, tools, and software.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
- B. Section 01 4000 - Quality Requirements: Product quality monitoring.
- C. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.
- D. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

#### **1.03 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.

### **PART 2 PRODUCTS**

#### **2.01 EXISTING PRODUCTS**

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

#### **2.02 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
  - 1. Made outside the United States, its territories, Canada, or Mexico.
  - 2. Made using or containing CFC's or HCFC's.
  - 3. Containing lead, cadmium, or asbestos.

### **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 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 LIMITATIONS**

- A. See Section 01 2500 - Substitution Procedures.

### **3.02 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

### **3.03 STORAGE AND PROTECTION**

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. 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. See Section 01 7419.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Provide off-site storage and protection when site does not permit on-site storage or protection.
  - 1. Execute a formal supplemental agreement between Owner and Contractor allowing off-site storage, for each occurrence.
- I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other



contaminants.

- J. Comply with manufacturer's warranty conditions, if any.
- K. Do not store products directly on the ground.
- L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- M. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- N. Prevent contact with material that may cause corrosion, discoloration, or staining.
- O. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- P. 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**

This page intentionally left blank

**SECTION 01 6116  
VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.
- C. Requirement for installer certification that they did not use any non-compliant products.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Submittal procedures.
- B. Section 01 6000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- C. Section 07 9200 - Joint Sealants: Emissions-compliant sealants.

**1.03 DEFINITIONS**

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Interior paints and coatings applied on site.
  - 2. Interior adhesives and sealants applied on site, including flooring adhesives.
  - 3. Flooring.
  - 4. Products making up wall and ceiling assemblies.
  - 5. Thermal and acoustical insulation.
  - 6. Other products when specifically stated in the specifications.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
  - 1. Interior paints and coatings applied on site.
  - 2. Interior adhesives and sealants applied on site.
  - 3. Other products when specifically stated in the specifications.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives whether specified or not.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
  - 1. Stone.
  - 2. Concrete.
  - 3. Clay brick.
  - 4. Metals that are plated, anodized, or powder-coated.
  - 5. Glass.
  - 6. Ceramics.

**1.04 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency current edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings 2005 (Reapproved 2018).
- C. CRI (GLP) - Green Label Plus Testing Program - Certified Products Current Edition.

- D. GreenSeal GS-36 - Standard for Adhesives for Commercial Use 2013.
- E. SCAQMD 1113 - Architectural Coatings 1977, with Amendment (2016).
- F. SCAQMD 1168 - Adhesive and Sealant Applications 1989, with Amendment (2022).
- G. SCS (CPD) - SCS Certified Products Current Edition.
- H. UL (GGG) - GREENGUARD Gold Certified Products Current Edition.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. VOC-Content-Restricted Products: VOC content not greater than required by the following:
  - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
  - 2. Aerosol Adhesives: GreenSeal GS-36.
  - 3. Joint Sealants: SCAQMD 1168 Rule.
  - 4. Paints and Coatings: Each color; most stringent of the following:
    - a. 40 CFR 59, Subpart D.
    - b. SCAQMD 1113 Rule.

### **PART 3 EXECUTION**

#### **3.01 FIELD QUALITY CONTROL**

- A. 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 Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

**END OF SECTION**

**SECTION 01 7000  
EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Surveying for laying out the work.
- C. Cleaning and protection.
- D. Demonstration and instruction of Owner personnel.
- E. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- F. General requirements for maintenance service.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
- C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.
- E. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.
- F. Section 02 4100 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

**1.03 REFERENCE STANDARDS**

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

**1.05 PROJECT CONDITIONS**

- A. Perform dewatering activities, as required, for the duration of the project.
- B. 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.
- C. 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.
- D. 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.

## **1.06 COORDINATION**

- A. See Section 01 1000 for occupancy-related requirements.
- B. 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.
- C. Notify affected utility companies and comply with their requirements.
- D. Coordinate completion and clean-up of work of separate sections.
- E. After Owner 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.

### **3.02 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Control datum for survey is that indicated on drawings.
- D. Utilize recognized engineering survey practices.
- E. 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.

### **3.03 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.

### **3.04 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Collect and remove waste materials, debris, and trash/rubbish from site daily and dispose off-site; do not burn or bury.

### **3.05 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.06 DEMONSTRATION AND INSTRUCTION**

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

### **3.07 FINAL CLEANING**

- A. Execute final cleaning prior to final project assessment.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces,
- C. Clean site; sweep paved areas, rake clean landscaped surfaces.
- D. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.08 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
  - 1. Provide copies to Architect and Owner.
- B. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
- C. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- D. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- E. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- F. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

### **3.09 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. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

This page intentionally left blank



**SECTION 01 7419  
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**PART 1 GENERAL**

**1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- C. Methods of trash/waste disposal that are not acceptable are:
  - 1. Burning on the project site.
  - 2. Burying on the project site.
  - 3. Dumping or burying on other property, public or private.
  - 4. Other illegal dumping or burying.
  - 5. Incineration, either on- or off-site.
- D. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: List of items to be salvaged from the existing building for relocation in project or for Owner.
- B. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- C. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- D. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- E. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

**1.03 DEFINITIONS**

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include

burning, incinerating, or thermally destroying waste.

- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 WASTE MANAGEMENT PROCEDURES**

- A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

#### **3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION**

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- C. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
  - 1. As a minimum, provide:
    - a. Separate dumpsters for each category of recyclable.
    - b. Recycling bins at worker lunch area.
  - 2. Provide containers as required.
  - 3. Provide temporary enclosures around piles of separated materials to be recycled or salvaged.
  - 4. Locate enclosures out of the way of construction traffic.
  - 5. Provide adequate space for pick-up and delivery and convenience to subcontractors.
  - 6. If an enclosed area is not provided, clearly lay out and label a specific area on-site.
  - 7. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

- D. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- E. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- F. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

**END OF SECTION**

This page intentionally left blank

**SECTION 01 7800  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 2. Submit two sets of revised final documents in final form with claim for final Application for Payment.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, with claim for final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Specifications.
  - 3. Addenda.
  - 4. Change Orders and other modifications to the Contract.
  - 5. Reviewed shop drawings, product data, and samples.
  - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  - 1. Manufacturer's name and product model and number.

2. Product substitutions or alternates utilized.
  3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Field changes of dimension and detail.
  2. Details not on original Contract drawings.

### **3.02 OPERATION AND MAINTENANCE DATA**

- A. Source Data: 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. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

### **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. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences.
- 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. Include manufacturer's printed operation and maintenance instructions.
- F. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

- G. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- H. Additional Requirements: As specified in individual product specification sections.

### **3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 3 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. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Project Directory.
  - 2. Table of Contents, of all volumes, and of this volume.
  - 3. Operation and Maintenance Data: Arranged by system, then by product category.
    - a. Source data.
    - b. Product data, shop drawings, and other submittals.
    - c. Operation and maintenance data.
    - d. Field quality control data.
    - e. Photocopies of warranties and bonds.
- K. Quantity: Submit three (3) copies of each type of manual (two (2) hard copies and one (1) electronic).

### **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 Owner's permission, leave date of beginning of time of warranty until 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**

This page intentionally left blank



## **SECTION 02 4100 DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Selective demolition of built site elements.
- B. Selective demolition of building elements for alteration purposes.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 00 3100 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.
- B. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.
- C. Section 01 1000 - Summary: Sequencing and staging requirements.
- D. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. 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; temporary bracing and shoring.
- G. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.
- H. Section 31 1000 - Site Clearing: Vegetation and existing debris removal.
- I. Section 31 1012 - Fine Grading

#### **1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2019.

#### **1.04 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
  - 1. Minimum of five years of documented experience.

### **PART 2 PRODUCTS -- NOT USED**

### **PART 3 EXECUTION**

#### **3.01 SCOPE**

- A. Remove portions of existing building:
  - 1. Building A: existing exterior siding, existing roofing, doors, frames, and hardware.
  - 2. Building B: existing interior framing, ceilings, casework, doors, frames, and hardware.

#### **3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with other requirements specified in Section 01 7000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Comply with applicable requirements of NFPA 241.
  - 3. Use of explosives is not permitted.
  - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of

- unstable structures.
- 5. Provide, erect, and maintain temporary barriers and security devices.
- 6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
- 7. Do not close or obstruct roadways or sidewalks without permit.
- 8. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
- 9. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- D. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- E. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- F. Perform demolition in a manner that maximizes salvage and recycling of materials.
  - 1. Comply with requirements of Section 01 7419 - Waste Management.
  - 2. Dismantle existing construction and separate materials.
  - 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.
- G. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

### **3.03 EXISTING UTILITIES**

- 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. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

### **3.04 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated and as required to accomplish new work.

1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
2. Remove items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Electrical, and Telecommunications):  
Remove existing systems and equipment as indicated.
  1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
  2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  3. Verify that abandoned services serve only abandoned facilities before removal.
  4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- D. Protect existing work to remain.
  1. Prevent movement of structure; provide shoring and bracing if necessary.
  2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  3. Repair adjacent construction and finishes damaged during removal work.
  4. Patch as specified for patching new work.

### **3.05 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

This page intentionally left blank

## SECTION 03 3000 - CAST-IN-PLACE CONCRETE

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes:
  - 1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
  - 1. Section 03 3003 "Cast-In-Place Concrete Requirements For Floor Slabs"
  - 2. Section 03 3511 "Concrete Floor Finishes"
  - 3. Section 31 2000 "Earth Moving" for drainage fill under slabs-on-ground.
  - 4. Section 32 1313 "Concrete Paving" for concrete pavement and walks.

#### 1.02 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

#### 1.03 ACTION SUBMITTALS

- A. Product Data: For each of the following.
  - 1. Portland cement.
  - 2. Fly ash.
  - 3. Slag cement.
  - 4. Blended hydraulic cement.
  - 5. Silica fume.
  - 6. Performance-based hydraulic cement
  - 7. Aggregates.
  - 8. Admixtures.
  - 9. Vapor retarders.
  - 10. Floor and slab treatments.
  - 11. Liquid floor treatments.
  - 12. Curing materials.
  - 13. Repair materials.
  - 14. Joint fillers
- B. Design Mixtures: For each concrete mixture, include the following:
  - 1. Mixture identification.
  - 2. Minimum 28-day compressive strength.
  - 3. Maximum w/cm.
  - 4. Calculated equilibrium unit weight, for lightweight concrete.
  - 5. Slump limit.
  - 6. Air content.
  - 7. Nominal maximum aggregate size.

- C. Shop Drawings:
  - 1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
    - a. Location of construction joints is subject to approval of the Architect.

#### **1.04 INFORMATIONAL SUBMITTALS**

- A. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Curing compounds.
  - 4. Vapor retarders.
- B. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Portland cement.
  - 2. Fly ash.
  - 3. Slag cement.
- C. Field quality-control reports.

#### **1.05 QUALITY ASSURANCE**

- A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.
- B. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
  - 1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- C. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- 1. Comply with ASTM C94/C94M and ACI 301.

#### **1.07 FIELD CONDITIONS**

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
  - 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 3. Do not use frozen materials or materials containing ice or snow.
  - 4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
  - 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
  - 1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

## **PART 2 PRODUCTS**

### **2.01 CONCRETE, GENERAL**

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

### **2.02 CONCRETE MATERIALS**

- A. Cementitious Materials:
  - 1. Portland Cement: ASTM C150/C150M.
  - 2. Fly Ash: ASTM C618, Class C or F.
- B. Normal-Weight Aggregates: ASTM C33/C33M, coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Alkali-Silica Reaction: Comply with one of the following:
    - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
    - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
    - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
  - 2. Maximum Coarse-Aggregate Size: 1 inch nominal.
  - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
  - 2. Retarding Admixture: ASTM C494/C494M, Type B.
  - 3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
  - 5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
  - 7. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.

- E. Water and Water Used to Make Ice: ASTM C94/C94M, potable.

### **2.03 VAPOR RETARDERS**

- A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

### **2.04 LIQUID FLOOR TREATMENTS**

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

### **2.05 CURING MATERIALS**

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.
- D. Water: Potable or complying with ASTM C1602/C1602M.
- E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

### **2.06 RELATED MATERIALS**

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber
- B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- C. Floor Slab Protective Covering: cellulose fabric.

### **2.07 CONCRETE MIXTURES, GENERAL**

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash or Other Pozzolans: 25 percent by mass.
  - 2. Slag Cement: 50 percent by mass.
  - 3. Silica Fume: 10 percent by mass.
  - 4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
  - 5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
- C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

### **2.08 CONCRETE MIXTURES**



- A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.
  - 1. Exposure Class: ACI 318 F1
  - 2. Minimum Compressive Strength: 3500 psi at 28 days.
  - 3. Maximum w/cm: 0.50
  - 4. Slump Limit: 5 inches, plus or minus 1 inch
  - 5. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
  
- B. Class B: Normal-weight concrete used for curbs, piers, exterior concrete.
  - 1. Exposure Class: ACI 318 F3
  - 2. Minimum Compressive Strength: 5000 psi at 28 days.
  - 3. Maximum w/cm: 0.40
  - 4. Slump Limit: 4 inches, plus or minus 1 inch
  - 5. Air Content:
    - a. 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size
  - 6. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
  
- C. Class C: Normal-weight concrete used for interior slabs-on-ground.
  - 1. Exposure Class: ACI 318 F0.
  - 2. Minimum Compressive Strength: 4000 psi at 28 days.
  - 3. Maximum w/cm: 0.45
  - 4. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

## **2.09 CONCRETE MIXING**

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94, and furnish batch ticket information.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verification of Conditions:
  - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
  - 2. Do not proceed until unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
  - 1. Daily access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

### **3.03 INSTALLATION OF EMBEDDED ITEMS**

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
  1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

### **3.04 INSTALLATION OF VAPOR RETARDER**

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
  1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
  2. Face laps away from exposed direction of concrete pour.
  3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
  4. Lap joints 6 inches and seal with manufacturer's recommended tape.
  5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
  6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
  7. Protect vapor retarder during placement of reinforcement and concrete.
    - a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

### **3.05 JOINTS**

- A. Construct joints true to line, with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
  1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
  2. Place joints perpendicular to main reinforcement.
    - a. Continue reinforcement across construction joints unless otherwise indicated.
    - b. Do not continue reinforcement through sides of strip placements of floors and slabs.
  3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
  1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.06 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
  2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
1. If a section cannot be placed continuously, provide construction joints as indicated.
  2. Deposit concrete to avoid segregation.
  3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
    - a. Do not use vibrators to transport concrete inside forms.
    - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
    - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
    - d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Do not place concrete floors and slabs in a checkerboard sequence.
  - 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 3. Maintain reinforcement in position on chairs during concrete placement.
  - 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 5. Level concrete, cut high areas, and fill low areas.
  - 6. Slope surfaces uniformly to drains where required.
  - 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
  - 8. Do not further disturb slab surfaces before starting finishing operations.

### **3.07 FINISHING FLOORS AND SLABS**

- A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish:
  - 1. While still plastic, texture concrete surface that has been screeded and bull-floated or dar-bied.
  - 2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
  - 3. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish:
  - 1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
  - 2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granu-lar texture and complies with ACI 117 tolerances for conventional concrete.
  - 3. Apply float finish to surfaces to receive trowel finish
- D. Trowel Finish:
  - 1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
  - 2. Continue troweling passes and restraighten until surface is free of trowel marks and uni-form in texture and appearance.
  - 3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 4. Do not add water to concrete surface.
  - 5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
  - 6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, paint, or another thin-film-finish coating system.

7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
  - a. Slabs on Ground:
    - 1) Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
  1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
  2. Coordinate required final finish with Architect before application.
- F. Filling In:
  1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
  2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
  3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- G. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

### 3.08 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
  1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
  2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
  3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.
- B. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
  1. Begin curing immediately after finishing concrete.
  2. Interior Concrete Floors:
    - a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
      - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
        - (a) Lap edges and ends of absorptive cover not less than 12-inches.
        - (b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
      - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
        - (a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
        - (b) Cure for not less than seven days.

- 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
  - (a) Water.
  - (b) Continuous water-fog spray.
- b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
  - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
    - (a) Lap edges and ends of absorptive cover not less than 12 inches.
    - (b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
  - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
    - (a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
    - (b) Cure for not less than seven days.
  - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
    - (a) Water.
    - (b) Continuous water-fog spray.
- c. Floors to Receive Curing Compound:
  - 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Maintain continuity of coating, and repair damage during curing period.
  - 4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
- d. Floors to Receive Curing and Sealing Compound:
  - 1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
  - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
  - 3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

### **3.09 TOLERANCES**

- A. Conform to ACI 117.

### **3.10 APPLICATION OF LIQUID FLOOR TREATMENTS**

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment in accordance with manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  2. Do not apply to concrete that is less than 14 days' old.
  3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
  4. Rinse with water; remove excess material until surface is dry.
  5. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller in accordance with manufacturer's written instructions.

### 3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least **[one] [six]** month(s).
  2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint, and trim joint filler flush with top of joint after hardening.

### 3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete:
1. Repair and patch defective areas when approved by Architect.
  2. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Unformed Surfaces:
1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.
    - a. Correct low and high areas.
    - b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  3. After concrete has cured at least 14 days, correct high areas by grinding.
  4. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar.
    - a. Finish repaired areas to blend into adjacent concrete.
  5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.
    - a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    - b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.
  - a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
  - b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.
  - a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
  - b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
  - c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
  - d. Place, compact, and finish to blend with adjacent finished concrete.
  - e. Cure in same manner as adjacent concrete.
8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.
  - a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
  - b. Dampen cleaned concrete surfaces and apply bonding agent.
  - c. Place patching mortar before bonding agent has dried.
  - d. Compact patching mortar and finish to match adjacent concrete.
  - e. Keep patched area continuously moist for at least 72 hours.
- D. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- E. Repair materials and installation not specified above may be used, subject to Architect's approval.

### **3.13 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
  1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
  2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.



3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
  - a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
    - 1) Project name.
    - 2) Name of testing agency.
    - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
    - 4) Name of concrete manufacturer.
    - 5) Date and time of inspection, sampling, and field testing.
    - 6) Date and time of concrete placement.
    - 7) Location in Work of concrete represented by samples.
    - 8) Date and time sample was obtained.
    - 9) Truck and batch ticket numbers.
    - 10) Design compressive strength at 28 days.
    - 11) Concrete mixture designation, proportions, and materials.
    - 12) Field test results.
    - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
    - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Inspections:
  1. Verification of use of required design mixture.
  2. Concrete placement, including conveying and depositing.
  3. Curing procedures and maintenance of curing temperature.
  4. Verification of concrete strength before removal of shores and forms from beams and slabs.
  5. Batch Plant Inspections: On a random basis, as determined by Architect.
- E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:
  1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  2. Slump: ASTM C143/C143M:
    - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
    - b. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;

- a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M:
  - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M:
  - a. Cast and laboratory cure two sets of three cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M.
  - a. Test one set of three laboratory-cured specimens at seven days and one set of two specimens at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
9. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
10. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

### **3.14 PROTECTION**

- A. Protect concrete surfaces as follows:
  1. Protect from petroleum stains.
  2. Diaper hydraulic equipment used over concrete surfaces.
  3. Prohibit vehicles from interior concrete slabs.
  4. Prohibit use of pipe-cutting machinery over concrete surfaces.
  5. Prohibit placement of steel items on concrete surfaces.
  6. Prohibit use of acids or acidic detergents over concrete surfaces.
  7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
  8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

**END OF SECTION 033000**

## SECTION 042200 - CONCRETE UNIT MASONRY

### PART 1 GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Single wythe concrete unit masonry and supplementary items necessary for installation.

#### 1.02 DEFINITIONS

- A. Load-Bearing Masonry: Masonry containing reinforcing steel in grouted cells for load-bearing assemblies designed by Structural Engineer to support axial (gravity) loads and lateral (wind/seismic) loads.
- B. Masonry Terminology: Refer to NCMA TEK 1-4 and other referenced quality standards.

#### 1.03 ACTION SUBMITTALS

- A. Product Data: Manufacturer's technical literature for each type of product and system indicated.
  - 1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.
- B. Shop Drawings: Show details of construction, including dimensioned drawings, plans, elevations, sections, and details of components to be incorporated into Work including, but not limited to, the following:
  - 1. Concrete Masonry Units: Show sizes, profiles, and coursing.
  - 2. Special Masonry Shapes: Submit large-scale details for each shape required or indicated.
  - 3. Flashing: Large-scale details for each element of flashing system showing layout, profiles, methods of joining, and anchorage details; including lintel units, shelf units, corner units, end dam units, conditions showing interface and relationship to adjacent materials, and other special applications.
  - 4. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced masonry assemblies.
  - 5. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
  - 6. Anchors, Ties, and Accessories: Show sizes, coursing, and locations.
  - 7. Control Joints: Show sizes and locations.

#### 1.04 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.
  - 1. Concrete Masonry Units: Material test reports substantiating compliance with specified requirements.
  - 2. Cementitious Materials: Each product required for mortar, including name of manufacturer, brand, type, and weight slips at time of delivery.
  - 3. Mortar Mixes: Certification of mortar mix design shall be based on evaluation of comprehensive tests performed. Include description of type and proportions of ingredients.

4. Grout Mixes: Certification of grout mix design shall be based on evaluation of comprehensive tests performed. Include description of type and proportions of ingredients.
  5. Reinforcing bars.
  6. Joint reinforcement: Each type and size of manufactured products.
  7. Anchors, Ties, and Accessories: Each type and size of manufactured products.
- B. Hot and Cold Weather Work Plan: Submit written plan detailing methods, materials and equipment to be used to comply with weather requirements.
- C. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".
- D. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required.
- E. Qualification Data:
1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include list of completed projects.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Manufacturer with not less than 10 years of experience in the successful production and in-service performance of products and systems similar to scope of this Project.
- B. Installer Qualifications:
1. Experience: Installer's personnel with not less than 10 years of experience in the successful performance of Work similar to scope of this Project.
  2. Supervision: Installer shall maintain a competent supervisor at Project while the Work is in progress, and who has not less than 10 years of experience installing products and systems similar to scope of this Project.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated..
- D. Pre-Construction Testing: Owner will employ and pay an independent testing agency to perform pre-construction testing to establish compliance of proposed Work with specified requirements.
1. Concrete Masonry Units:
    - a. General Requirements: Test units for following:
      - 1) Dimensions.
      - 2) Compressive strength.
      - 3) Absorption.
      - 4) Unit Weight (Density).
      - 5) Moisture Content.
    - b. Test Method: ASTM C 140.
  2. Grout:
    - a. General Requirements: Test each grout mix for compressive strength to establish standard for field testing specified under "Field Quality Control" Article.
    - b. Test Method: ASTM C 1019.

- c. Specimen Quantity: Provide required number of mortar samples.
- d. Reports: Interpret test results and prepare certified reports.
- e. Equivalent Option to Testing: Testing will not be required if manufacturer's data is based on previous testing, not older than 2 years.
- f. Retesting: Retesting of materials failing to meet specified requirements shall at Contractor's expense.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Label pallets of masonry units with manufacturers name, product name, and information required to identify products.
- B. Storage:
  - 1. Masonry Units: Store on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
  - 2. Cementitious Materials: Store on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
  - 3. Aggregates: Store where grading and other required characteristics can be maintained and contamination avoided.
  - 4. Accessories: Store to prevent corrosion and accumulation of dirt and oil.

#### **1.07 PROJECT CONDITIONS**

- A. Protection during Work: Prevent excess moisture from entering Work in progress.
  - 1. Cover tops of walls, projections, and sills with water-repellent tarps or heavy plastic sheets at end of each day's Work.
  - 2. Cover partially completed masonry when construction is not in progress.
  - 3. Extend cover minimum of 24 in (600 mm) down both sides and hold cover securely in place.
  - 4. Protect door and window frames from damage.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
  - 1. Protect walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  - 2. Protect sills, ledges, and projections from mortar droppings.
  - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- C. Cold Weather Requirements: Comply with building code or TMS 602/ACI 530.1/ASCE 6 whichever is more stringent, and the following:
  - 1. Do not apply when ambient temperature is less than 32 deg F (0 deg C) or when 40 deg F (4.4 deg C) or less and falling.
  - 2. Provide heat and protection (temporary or permanent) as required to protect Work from freezing for not less than 48 hours after application.

3. Distribute heat uniformly to prevent concentration of heat near sources; provide deflection or protective screens.
  4. Do not use frozen materials or materials mixed or coated with ice or frost.
  5. Do not build on frozen substrates.
  6. Remove and replace masonry damaged by frost or freezing conditions.
  7. Use liquid cleaning methods only when air temperature is 40 deg F (4.4 deg C) and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- D. Warm Weather Requirements: Comply with building code or TMS 602/ACI 530.1/ASCE 6 whichever is more stringent, and the following:
1. Protect Work against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.
  2. Apply and cure work as required by climatic and job conditions to prevent dryout during cure period.
  3. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

## **1.08 COORDINATION**

- A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS AND PRODUCTS**

- A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
- B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other available manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

### **2.02 MATERIALS, GENERAL**

- A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.
- B. Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within ranges accepted for these characteristics.
- C. Cementitious Materials: Obtain cementitious ingredients of a uniform quality, including color, for each component.

### **2.03 MASONRY UNITS, GENERAL**

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified

dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

- B. Special Shapes: Provide shapes indicated and as follows for each form of masonry unit required:
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. At interior locations, provide bullnosed units for outside exposed corners, unless otherwise indicated.
  - 3. At exterior locations, provide square-edged units for outside exposed corners, unless otherwise indicated.
- C. Match Existing Masonry: Wherever "match existing" indicated, provide masonry unit of matching color, texture, and size as existing adjacent masonry work.

#### **2.04 PERFORMANCE REQUIREMENTS**

- A. Load Bearing Masonry:
  - 1. Provide reinforced masonry that develops net-area compressive strengths ( $f'_m$ ) at 28 days as indicated on Structural Drawings.
  - 2. Determine net-area compressive strength ( $f'_m$ ) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method).
- B. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119/NFPA 251/ UL 623 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

#### **2.05 CONCRETE MASONRY UNITS (CMU)**

- A. Product Quality Standard: ASTM C 90, with following physical properties:
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2200 psi (13.1 MPa) for 3 units and minimum 2000 psi (11.7 MPa) for individual unit.
  - 2. Medium weight, unless otherwise indicated.
  - 3. Size (Width): Manufactured to dimensions 3/8 in (10 mm) less than nominal dimensions.
  - 4. Exposed Faces: Manufacturer's standard.
  - 5. Faces to Receive Direct Bonded Portland Cement Plaster: Provide coarse textured face units made with gap-graded aggregates.

#### **2.06 LINTELS**

- A. Steel Angle Lintels: Materials complying with Division 05 Section "Metal Fabrications" for loose masonry lintels (Designation MF), with schedule as shown on the Drawings.
- B. Cast-in-Place Concrete Lintels: Concrete materials complying with Division 03 Section "Cast-in-Place Concrete" for color, texture, and compressive strength indicated or required, and with reinforcing bars to support loads indicated.
- C. Precast Concrete Lintels: As specified in Division 03 Section "Architectural Precast Concrete".

- D. Masonry Lintels: Prefabricated or built-in-place masonry lintels as shown of the Drawings made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout. Cure prefabricated lintels before handling and installing.

## **2.07 MORTAR AND GROUT MATERIALS**

- A. Portland Cement:
1. Material Quality Standard: ASTM C 150, Type I; except Type III may be used for cold-weather construction.
  2. Color: Natural gray color or white cement as required to produce mortar color required.
  3. Manufacturers:
    - a. Lafarge North America.
    - b. Lehigh Cement Co.
    - c. Lone Star Industries, Inc.
    - d. Rinker Materials.
    - e. Royal White Cement.
  4. Types of Cements Not permitted:
    - a. Masonry Cement: ASTM C 91.
    - b. Mortar Cement: ASTM C 1329.
  5. Hydrated Lime:
    - a. Material Quality Standard: ASTM C 207, Type S.
    - b. Manufacturers:
      - 1) Graymont Dolime (OH) Inc.
      - 2) Rockwell Lime Co.
- B. Portland Cement-Lime Mix: Packaged blend of Portland cement and hydrated lime containing no other ingredients.
- C. Aggregate for Standard Gray Mortar:
1. Product Quality Standard: ASTM C 144.
  2. Mortar Exposed to View: Use washed aggregate consisting of natural sand or crushed stone.
  3. Joints Less Than 1/4 in (6 mm) Thick: Use aggregate graded with 100 percent passing the No. 16 (1.18 mm) sieve.
- D. Aggregate for Grout: ASTM C 404.
- E. Water: Potable, clean and free of amounts of oils, acids, alkalies, salts, organic materials, or other substances that are deleterious to mortar or any metal within the wall.

## **2.08 JOINT REINFORCEMENT**

- A. Masonry Joint Reinforcement, General:
1. Product Quality Standard: ASTM A 951 / A 951M.
  2. Interior Walls: Mill galvanized, carbon steel, ASTM A 641 / A 641M.
  3. Exterior Walls: Hot-dip galvanized, carbon steel, ASTM A 82 / A 82M with ASTM A 153 / A 153M, Class B-2 coating.
  4. Wire Size for Side Rods: 0.187 in (4.76 mm) diameter or as indicated.
  5. Wire Size for Cross Rods: 0.148 in (3.77mm) diameter or as indicated.
  6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 in (400 mm) on centers.



7. Lengths: Not less than 10 ft (3 m), with prefabricated corner and tee units.
- B. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.
- C. Masonry Joint Reinforcement for Multi-wythe Masonry:
  1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing veneer wythe.
    - a. Ties shall have two hooks that engage eyes or slots in reinforcement and resist movement perpendicular to wall.
    - b. Ties shall extend at least halfway through facing veneer wythe but with at least 5/8 in (15 mm) cover on outside face.
- D. Manufacturers:
  1. Heckmann Building Products, Inc.
  2. Hohmann & Barnard, Inc.
  3. Wire-Bond.

## **2.09 REINFORCEMENT**

- A. Uncoated Steel Reinforcing Bars Product Quality Standard: ASTM A 615 / A 615M or ASTM A 996 / A 996M, Grade 60 (Grade 420). Sizes as indicated on the Drawings.

## **2.10 ANCHORS AND TIES**

- A. Materials:
  1. Interior Walls:
    - a. Mill Galvanized, Carbon Steel Wire, ASTM A 82 / A 82M with ASTM A 641 / A 641M, Class 1 coating.
    - b. Galvanized Steel Sheet, ASTM A 653 / A 653M, Commercial Steel, G60 (Z180) zinc coating.
  2. Exterior Walls:
    - a. Hot-Dip Galvanized, Carbon Steel Wire: ASTM A 82 / A 82M with ASTM A 153 / A 153M, Class B-2 coating.
    - b. Steel Sheet, Galvanized after Fabrication: ASTM A 1008 / A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153 / A 153M.
- B. Sizes and Thicknesses: If not indicated below, as shown on Drawings, required by building code, or required by TMS 602/ACI 530.1/ASCE 6.
- C. Adjustable Anchors for Connecting to Concrete or Structural Steel:
  1. Description: Two-piece adjustable veneer anchoring system.
    - a. Anchors: Zinc alloy barrel, flanged head, screw and eye, with drilling threads suitable for structural substrate.
    - b. Ties: Hot-dip galvanized, carbon-steel wire, 3/16 in (5 mm) pre-coated diameter, triangular shaped ties, size as required to provide maximum bond, not less than 2 in (50 mm).
  2. Basis of Design: Heckmann Building Products, Inc.; "POS-I-TIE Masonry Veneer Anchor System".
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4 in (6 mm) diameter wire.
  2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 in (25 mm) of masonry face.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 in (38 mm) wide by 1/4 in (6 mm) thick by 24 in (600 mm) long, with ends turned up 2 in (50 mm) or with cross pins, unless otherwise indicated, or bent to configuration indicated.

## **2.11 MISCELLANEOUS MASONRY ACCESSORIES**

- A. Compressible Filler:
1. Product Quality Standard: ASTM D 1056, Grade 2A1.
  2. Description: Pre-molded filler strips formulated from neoprene; compressible up to 35 percent; of width and thickness indicated.
- B. Pre-formed Control Joint Gaskets:
1. Product Quality Standard: ASTM D 2000, Designation M2AA-805.
  2. Description: Formed from styrene-butadiene-rubber compound designed to fit standard sash block to maintain lateral stability in masonry wall.
- C. Bond Breaker Strips:
1. Product Quality Standard: ASTM D 226, Type I.
  2. Description: Asphalt-saturated, organic roofing felt (No. 15 asphalt felt).
- D. Reinforcing Bar Positioners:
1. Description: Wire units designed to fit into mortar bed joints spanning masonry unit cells with loops for holding reinforcing bars in center of cells. Units are formed from 0.142 in (3.6 mm) steel wire, hot-dip galvanized after fabrication. Provide units with either two loops or four loops as needed for number of bars indicated.
  2. Manufacturers and Products:
    - a. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
    - b. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
    - c. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.
- E. Cavity Wall Insulation: As specified in Division 07 Section "Thermal Insulation".

## **2.12 MORTAR AND GROUT MIXES**

- A. General: Mix cementitious materials in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency for minimum 3 minutes to 5 minutes; do not hand mix.
1. Admixture Limitation: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, calcium chloride, or other admixtures, unless otherwise indicated.
  2. Cementitious Limitation: Limit cementitious materials in mortar and grout to Portland cement and lime.
  3. Ingredient Measurement: Measure in a one cubic foot batching box before mixing for component materials not pre-blended, prepackaged or containerized.
  4. Aggregate Moisture Content: Monitor moisture content of aggregates and exercise caution when mixing to avoid over or under-sanding of the mortar.

- B. Pre-blended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a pre-blended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project.
- C. Mortar Mix:
  - 1. Mix Quality Standard: ASTM C 270, Proportion Specification for portland cement-lime mortars, Types as follows for applications stated unless another type is indicated:
    - a. Non-Load-Bearing (Non-Reinforced) Masonry: Type N.
    - b. Load-Bearing (Reinforced) Masonry: Type S.
    - c. Other Applications: Type N where another type is not indicated.
  - 2. Mortar Color: Standard gray, unless indicated otherwise.
  - 3. Match Existing Mortar: Wherever "match existing" indicated, provide masonry mortar of matching color and texture as existing adjacent masonry veneer work.
  - 4. Basis of Design: As scheduled or as indicated in Design Selections.
- D. Grout for Unit Masonry:
  - 1. Product Quality Standard: ASTM C 476.
  - 2. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
  - 3. Use fine grout in grout spaces less than 2 in (50 mm) in horizontal dimension.
  - 4. Use coarse grout in grout spaces 2 in (50 mm) or more in least horizontal dimension.
  - 5. Provide grout with a slump of 8 to 11 in (200 to 275 mm) as measured according to ASTM C 143 / C 143M.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

### **3.02 INSTALLATION, GENERAL**

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
  - 1. TMS 602/ACI 530.1/ASCE 6, unless local building code has jurisdiction.
  - 2. Applicable portions of NCMA TEK's.
  - 3. Respective manufacturer's written installation instructions.
  - 4. Accepted submittals.
  - 5. Contract Documents.
  - 6. PCA - Concrete Masonry Handbook, if no other installation quality standard applies to condition.

### **3.03 PREPARATION**

- A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

### **3.04 INSTALLATION OF CONCRETE UNIT MASONRY**

- A. Thickness: Build single-wythe masonry walls to actual widths of masonry units, using units of widths indicated.
- B. Chases and Recesses: Build to accommodate items specified in this and other Sections.
- C. Openings: Leave for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Cutting: Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Mortar Workability: Mortar with added color pigments shall not be retempered. Discard mortar that has begun to stiffen or is not used within 2.5 hours after initial mixing.
- F. Match Existing Masonry Veneer: Match coursing and bonding of existing masonry veneer.

### **3.05 SHELF ANGLES AND LINTELS**

- A. Steel Shelf Angles: Erection as specified in Division 05 Section "Metal Fabrications".
- B. Steel Loose Lintels: Set where indicated or required, with not less than 8 in (200 mm) of bearing at each jamb, unless otherwise indicated.
- C. Precast Concrete Lintels: Set where indicated, with not less than 8 in (200 mm) of bearing at each jamb, unless otherwise indicated.
- D. Masonry Lintels: Construct in place using formwork and shoring of sufficient strength to support Work, until strength has been achieved and assembly is cured.

### **3.06 LAYING MASONRY WALLS**

- A. General: Lay out walls in advance for accurate spacing of surface bond patterns, uniform joint thicknesses, accurate location of openings, movement-type joints, returns, and offsets. Avoid using less than half-size units at corners, jambs, and, where possible at other locations.
- B. Bond Pattern for Exposed Masonry:
  - 1. Exposed Masonry: Unless otherwise indicated, lay units in a wythe with all units in one-half running bond.
  - 2. Concealed Masonry: Lay units in a wythe in running bond or bonded by lapping not less than 4 in (100 mm) lap.
  - 3. Corners: Bond and interlock each course of each wythe. Do not use units with less than nominal 8 in (200 mm) horizontal face dimensions at corners or jambs.
  - 4. Provide scheduled finish on all exposed surfaces, including corners.
  - 5. Mitered corners are not allowed.

- C. Stopping and Resuming Work: In each course, rack back appropriate unit length for bond pattern; do not tooth. When resuming Work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.
- D. Built-in Work:
  - 1. As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
  - 2. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.
  - 3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.
- E. Concrete Masonry Cores under Loads: Fill cores in hollow concrete masonry units with grout 24 in (600 mm) under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.
- F. Top of Fire-Rated Partitions: Treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems".

### **3.07 MORTAR BEDDING AND JOINTING**

- A. General Procedures:
  - 1. Do not disturb previously laid units.
  - 2. Spread mortar for bed joint only so far ahead of laying units that mortar will be plastic when units are laid.
  - 3. Butter end of unit with ample mortar so that head joint is completely filled with mortar when placed.
  - 4. Do not deeply furrow bed joints or slush head joints.
  - 5. Avoid over-plumbing and pounding of corners and jambs to fit stretcher unit after setting in place. Where adjustments must be made after initial setting, remove mortar and replace with fresh mortar.
  - 6. Rock closures into place with both head joints and closure space spread with ample mortar. Place against adjacent units so that both horizontal and vertical joints are completely filled.
- B. Mortar Joint Thickness: Minimum 3/8 in (10 mm) wide for head and bed joints.
- C. Hollow Concrete Masonry Units: Lay as follows:
  - 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
  - 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
  - 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
  - 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- D. Solid Concrete Masonry Units: Lay with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- E. Joint Tooling: Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

1. Make mortar joints straight, clean, and uniform in thickness. Tool joints to produce dense surface well bonded to edges.
2. Joints which are not tight at time of tooling shall be raked out, pointed, and then tooled.
3. Tool when mortar is partially set but still sufficiently plastic to bond.
4. Use a tool which compacts mortar, pressing excess mortar out of joint rather than dragging it out.
5. Tool vertical joint first.

### **3.08 MASONRY CAVITY WALLS**

- A. General: Refer to Division 04 Section "Masonry Veneer" for cavity wall requirements.
- B. Thickness: Build multi-wythe masonry cavity walls to full thickness shown.

### **3.09 MASONRY JOINT REINFORCEMENT**

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 in (15 mm) on exterior side of walls, 1/2 in (12 mm) elsewhere. Lap reinforcement a minimum of 6 in (150 mm).
  1. Space reinforcement not more than 16 in (400 mm) on centers.
  2. Space reinforcement not more than 8 in (200 mm) on centers in parapet walls.
  3. Provide reinforcement not more than 8 in (200 mm) above and below wall openings and extending 12 in (300 mm) beyond openings.
- B. Installation Conditions:
  1. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
  2. Provide continuity at wall intersections by using prefabricated T-shaped units.
  3. Provide continuity at corners by using prefabricated L-shaped units.
  4. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### **3.10 ANCHORING MASONRY TO STRUCTURAL MEMBERS**

- A. Structural Anchors to Building Structure: Anchor masonry to structural members where masonry abuts or faces structural members to comply with following:
  1. Unless otherwise indicated, provide an open space not less than 1 in (25 mm) in width between masonry and structural member. Keep open space free of mortar and other rigid materials.
  2. Anchor masonry to structural members with anchors embedded in masonry joints and attached to structure.
  3. Space anchors as indicated, but not more than 24 in (600 mm) on centers vertically and 36 in (900 mm) on centers horizontally.
  4. Refer to Division 05 Section "Metal Fabrications" for requirements related to coordination between masonry and metal fabrications (Designation MF), including loose masonry lintel schedule, as shown on the Drawings.

### **3.11 ANCHORING MASONRY VENEERS**

- A. General: Refer to Division 04 Section "Masonry Veneer" for anchoring masonry veneer requirements.

### 3.12 CONTROL JOINTS

- A. General: Install control joint materials as masonry progresses. Do not allow materials to span control joints without provision to allow for in-plane wall or partition movement. Maintain joints free and clear of mortar.
- B. Control Joints: Form in concrete masonry using one of following methods:
  - 1. Install preformed control-joint gaskets designed to fit standard sash block.
  - 2. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
  - 3. At structural bond beams, provide dummy groove or raked joint. Do not extend control joints through bond beams.
- C. Control Joint Spacing: Locate control joints as indicated on the Drawings not to exceed 25 ft (7.5 m) on center. Keep control joints straight, true, and continuous from top to bottom of masonry. Form open control joint of width indicated for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants".
- D. Horizontal Joints: Build in horizontal pressure-relieving joints as indicated; construct of width required for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants".

### 3.13 LINTELS

- A. Steel Angle or Wide Flange Lintels: Install where indicated and as scheduled on the Drawings.
- B. Concrete or Masonry Lintels: Provide lintels where shown and where openings of more than 24 in (600 mm) for block-size units are shown without structural steel or other supporting lintels.
  - 1. Provide precast concrete lintels made from concrete matching concrete masonry units in color, texture, and compressive strength and with reinforcing bars required to support loads indicated.
  - 2. Provide prefabricated or built-in-place masonry lintels. Use specially formed bond beam units with reinforcing bars placed and filled with coarse grout. Cure precast lintels before handling and installing.
- C. Minimum Bearing: Provide 8 in (200 mm) at each jamb, unless otherwise indicated.

### 3.14 LOAD-BEARING MASONRY

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
  - 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  - 2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
  - 1. Provide minimum bar lap splice not less than 48 bar diameters unless otherwise indicated.

2. Provide corner bars of same size and spacing as horizontal bars unless otherwise indicated.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height unless otherwise required by local applicable code.
  2. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.
  3. Limit height of vertical grout pours to not more than 60 in (1500 mm).
  4. Fill with grout, vertical cells, bond beams, lintels and other structural members having reinforcement. Secure in place and inspect reinforcing before grouting. Keep mortar droppings out of grout space and puddle or vibrate grout in place.
  5. Provide solid bearing under structural members at least 8 in (200 mm) vertically and at least 16 in (400 mm) horizontally. Bearing may be solid units, or hollow units with grout. Fill cells in units adjacent to openings.
  6. Grout from inside face of masonry and prevent grout from staining masonry face. Protect projecting surfaces from droppings and clean immediately any grout which comes in contact with face of masonry.

### 3.15 TOLERANCES

- A. Conspicuous Lines:
1. Vertical: For such conditions as external corners, door and window jambs, reveals, and expansion joints, maximum variation of one of following from plumb:
    - a. 1/8 in (3 mm) per 10 ft (3 m).
    - b. 1/4 in (6 mm) per 20 ft (6 m).
    - c. 1/2 in (12 mm) overall.
  2. Horizontal: For such conditions as exposed lintels, sills, door and window heads, parapets, and reveals, maximum variation of one of following from level:
    - a. 1/8 in (3 mm) per 10 ft (3 m).
    - b. 1/4 in (6 mm) per 20 ft (6 m).
    - c. 1/2 in (12 mm) overall.
- B. Exposed Head Joints:
1. Vertical Alignment: Maximum variation of one of following from plumb:
    - a. 1/4 in (6 mm) per 10 ft (3 m).
    - b. 1/2 in (12 mm) from plumb top to bottom of wall.
  2. Thickness: Maximum variation from width indicated of plus or minus 1/8 in (3 mm); maximum variation from adjacent bed joint and head joint thicknesses 1/8 in (3 mm).
- C. Exposed Bed Joints: Maximum variation from width indicated of plus or minus 1/8 in (3 mm), with a maximum thickness limited to 1/2 in (12 mm); maximum variation from bed joint thickness of adjacent courses of 1/8 in (3 mm).
- D. Flush Alignment: Maximum variation of 1/16 in (1.5 mm) except due to warpage of masonry units with tolerances specified for warpage of units.



### 3.16 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service - Masonry Veneer Cleaning Product: Manufacturer's qualified technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.
1. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with experience in providing recommendations, observations, evaluations, and problem diagnostics.
- B. Testing Agency Field Service: The Owner may employ and pay a qualified independent testing agency to perform field quality control. Materials and installation failing to meet specified requirements shall be replaced at Contractor's expense. Retesting of materials and installations failing to meet specified requirements shall be done at Contractor's expense.
1. Mortar Tests: Verify mortar composition with specified requirements according to ASTM C 780, Annex A4; made at following times during Work:
    - a. First day.
    - b. 5 percent.
    - c. 15 percent.
    - d. 30 percent.
    - e. 60 percent.
  2. Grout Test: Test each mix provided, according to ASTM C 1019 for compressive strength.
  3. Testing Frequency: One set of tests for each 5000 sf (465 sm) of wall area or portion thereof unless otherwise indicated.
  4. Inspections: Testing agency will visit project site periodically at random, but not less than once during each week of masonry Work, to inspect progress and to ascertain if Work complies with Contract Documents. Allow inspectors access to scaffolding and Work areas, as needed to perform inspections. Inspections will include verification that:
    - a. Materials are properly stored.
    - b. Installation is within specified construction tolerances.
    - c. Proper mortar ingredients and mixing techniques are being used.
    - d. Mortar time on board is within specified limits.
    - e. Bed and head joints are being properly made.
    - f. Anchorages are as specified.
    - g. Joints are being properly tooled.
    - h. Flashing assembly is being properly fabricated and installed.
    - i. Weeps and vents are being installed and are functional.
    - j. Control joints are being installed as indicated, or, as specified.
  5. Evaluation of Quality Control Tests: Replace Work in areas where test results fail to comply with requirements indicated.

### 3.17 ADJUSTING

- A. Damaged Units: Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- B. Pointing: During tooling of joints, enlarge voids and holes, except weeps and vents, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

### **3.18 PROTECTION**

- A. Cleaning: During cleaning operations, protect surrounding areas, landscaping, adjacent surfaces, and vehicles from contact with cleaning products.
  - 1. Clean surfaces prior to installation of windows and doors.
  - 2. Avoid drifting of spray caused by wind.

### **3.19 CLEANING**

- A. In-Progress Cleaning: Clean unit masonry as Work progresses by dry brushing to remove mortar fins and smears before tooling joints.

### **3.20 SCHEDULE**

- A. Basis of Design: CMU01
  - 1. Manufacturer:
  - 2. Product Series:
  - 3. Color Name and Number:
  - 4. Face Texture:
  - 5. Size (Actual Dimensions)
    - a. Width: 7-5/8 in (190 mm).
    - b. Height: 7-5/8 in (190 mm).
    - c. Length: 15-5/8 in (390 mm).
- B. Mortar Color - Basis of Design: Use with CMUXX.
  - 1. Manufacturer:
  - 2. Product Series:
  - 3. Color Name and Number:

**END OF SECTION**

## **SECTION 051200 - STRUCTURAL STEEL FRAMING**

### **PART 1 GENERAL**

#### **1.01 SUMMARY**

- A. Section Includes:
  - 1. Structural steel.
  - 2. Shrinkage-resistant grout.
- B. Related Requirements:
  - 1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
  - 2. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.
  - 3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting requirements.

#### **1.02 DEFINITIONS**

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

#### **1.03 COORDINATION**

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

#### **1.04 ACTION SUBMITTALS**

- A. Product Data:
  - 1. High-strength, bolt-nut-washer assemblies.
  - 2. Shop primer.
  - 3. Galvanized-steel primer.
  - 4. Shrinkage-resistant grout.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment Drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
  - 5. Identify members not to be shop primed.

#### **1.05 INFORMATIONAL SUBMITTALS.**

- A. Survey of existing conditions.

- B. Field quality-control reports.

## **1.06 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

## **PART 2 PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

- A. Comply with applicable provisions of the following specifications and documents:
  - 1. ANSI/AISC 303.
  - 2. ANSI/AISC 341.
  - 3. ANSI/AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

### **2.02 STRUCTURAL-STEEL MATERIALS**

- A. W-Shapes: ASTM A992 Grade 50.
- B. Channels, Angles: ASTM A36.
- C. Plate and Bar: ASTM A36
- D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B
- E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

### **2.03 BOLTS AND CONNECTORS**

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436, Type 1, hardened carbon-steel washers; all with plain finish.

### **2.04 RODS**

- A. Unheaded Anchor Rods: ASTM F1554, Grade 36

- B. Threaded Rods: ASTM A36

## **2.05 PRIMER**

- A. Steel Primer:
  - 1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

## **2.06 SHRINKAGE-RESISTANT GROUT**

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## **2.07 FABRICATION**

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.
  - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
  - 4. Mark and match-mark materials for field assembly.
  - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## **2.08 SHOP CONNECTIONS**

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

- C. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  - 2. Galvanize all steel exposed to weather.

## **2.09 SHOP PRIMING**

- A. Shop prime steel surfaces, except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits.
- C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.
- D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

## **2.10 SOURCE QUALITY CONTROL**

- A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.
  - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Bolted Connections: Inspect shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1 and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E165/E165M.
    - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    - c. Ultrasonic Inspection: ASTM E164.
    - d. Radiographic Inspection: ASTM E94/E94M.
  - 4. Prepare test and inspection reports.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
  - 1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

### **3.03 ERECTION**

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

### **3.04 FIELD CONNECTIONS**

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
- B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

### **3.05 REPAIR**

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.
- B. Touchup Painting:
  - 1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

### **3.06 FIELD QUALITY CONTROL**

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
  - 1. Bolted Connections: Inspect bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
  - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1.
    - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
      - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      - 3) Ultrasonic Inspection: ASTM E164.
      - 4) Radiographic Inspection: ASTM E94/E94M.

**END OF SECTION**



---

---

## SECTION 061000 – ROUGH CARPENTRY

### PART 1 GENERAL

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.
2. SUMMARY
  - a. Section Includes:
    - 1) Framing with dimension lumber.
    - 2) Framing with timber.
    - 3) Framing with engineered wood products.
    - 4) Wood blocking and nailers.
    - 5) Wood sleepers.
  - b. Related Requirements:
    - 1) Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
3. DEFINITIONS
  - a. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
  - b. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
  - c. OSB: Oriented strand board.
  - d. Timber: Lumber of 5 inches nominal size or greater in least dimension.
4. ACTION SUBMITTALS
  - a. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
    - 1) Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
5. QUALITY ASSURANCE
  - a. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
6. DELIVERY, STORAGE, AND HANDLING
  - a. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 PRODUCTS

1. WOOD PRODUCTS, GENERAL
  - a. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

- 
- 1) Factory mark each piece of lumber with grade stamp of grading agency.
  - 2) Dress lumber, S4S, unless otherwise indicated.
  - b. Maximum Moisture Content of Lumber: 19 percent at time of close-in unless otherwise indicated.
  - c. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
    - 1) Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.
2. WOOD-PRESERVATIVE-TREATED LUMBER
- a. Preservative Treatment by Pressure Process: Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
    - 1) Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
  - c. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
  - d. Application: Treat items indicated on Drawings, and the following:
    - 1) Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
    - 2) Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
    - 3) Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
    - 4) Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
    - 5) Wood floor plates that are installed over concrete slabs-on-grade.
3. DIMENSION LUMBER FRAMING
- a. Non-Load-Bearing Interior Partitions: No. 2 grade.
    - (a) Hem-fir (north); NLGA.
    - (b) Southern pine or mixed southern pine; SPIB.
    - (c) Spruce-pine-fir; NLGA.
    - (d) Hem-fir; WCLIB, or WWPA.
    - (e) Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
    - (f) Northern species; NLGA.
    - (g) Eastern softwoods; NeLMA.
    - (h) Western woods; WCLIB or WWPA.
  - b. Load-Bearing Partitions & general framing: No. 2 grade.
    - 1) Species:

- (a) Hem-fir (north); NLGA.
  - (b) Southern pine; SPIB.
  - (c) Douglas fir-larch; WCLIB or WWPA.
  - (d) Southern pine or mixed southern pine; SPIB.
  - (e) Spruce-pine-fir; NLGA.
  - (f) Douglas fir-south; WWPA.
  - (g) Hem-fir; WCLIB or WWPA.
  - (h) Douglas fir-larch (north); NLGA.
  - (i) Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
4. TIMBER FRAMING
- a. Comply with the following requirements, according to grading rules of grading agency indicated:
    - 1) Species and Grade: Douglas fir-larch, Douglas fir-larch (north), or Douglas fir-south; No. 1 grade; NLGA, WCLIB, or WWPA.
    - 2) Species and Grade: Hem-fir or hem-fir (north); [Select Structural] [No. 1] grade; NLGA, WCLIB, or WWPA.
    - 3) Species and Grade: Southern pine; No. 1 grade; SPIB.
5. ENGINEERED WOOD PRODUCTS
- a. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.
  - b. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.
    - 1) Extreme Fiber Stress in Bending, Edgewise: 2600 psi
    - 2) Modulus of Elasticity, 1,800,000 psi
6. WOOD BASED STRUCTURAL-USE PANELS
- a. Provide either all-veneer, mat-formed, or composite panels complying with DOC PS 2, "Performance Standard for Wood-Based Structural-use Panels," unless otherwise indicated. Provide plywood panels complying with DOC PS 1, "U.S. Product Standard for Construction and Industrial Plywood," where plywood is indicated.
  - b. Trademark: Factory mark structural-use panels with APA trademark evidencing compliance with grade requirements.
  - c. Span Ratings: Provide panels with span ratings required to suit support spacing indicated.
  - d. Span Ratings: Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
  - e. Roof Sheathing: APA-rated plywood, Exposure 1
  - f. Wall Sheathing: APA-rated plywood or OSB, Exposure 1
  - g. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade, C-D Plugged Exposure 1, in thickness indicated or, if not otherwise indicated, not less than 15/32 inch (11.9 mm) thick.
7. FASTENERS
- a. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

- 1) Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
  - b. Nails, Brads, and Staples: ASTM F1667.
  - c. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
8. METAL FRAMING ANCHORS
- a. Allowable design loads, as published by manufacturer, shall meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

### **PART 3 EXECUTION**

1. INSTALLATION, GENERAL
  - a. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
  - b. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
  - c. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
  - d. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
  - e. Do not splice structural members between supports unless otherwise indicated.
  - f. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
    - 1) Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
  - g. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
  - h. Comply with AWWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
    - 1) Use inorganic boron for items that are continuously protected from liquid water.
    - 2) Use copper naphthenate for items not continuously protected from liquid water.
  - i. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
  - j. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
    - 1) Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
  - k. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners

- without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.
2. **INSTALLATION OF WOOD BLOCKING AND NAILERS**
    - a. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
    - b. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
  3. **INSTALLATION OF WOOD FURRING**
    - a. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
    - b. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal-size furring at 24 inches o.c.
    - c. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.
  4. **INSTALLATION OF WALL AND PARTITION FRAMING**
    - a. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
    - b. Construct corners and intersections with three or more studs.
    - c. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
  5. **INSTALLATION OF FLOOR AND CEILING JOIST FRAMING**
    - a. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry.
    - b. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.
    - c. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
  6. **INSTALLATION OF TIMBER FRAMING**
    - a. Install timber beams with crown edge up and provide not less than 4 inches of bearing on supports. Provide continuous members unless otherwise indicated; tie together over supports as indicated if not continuous.
    - b. Where beams or girders are framed into pockets of exterior concrete or masonry walls, provide 1/2-inch airspace at sides and ends of wood members.
    - c. Install wood posts using metal anchors indicated.
    - d. Treat ends of timber beams and posts exposed to weather by dipping in water-repellent preservative for 15 minutes.
  7. **INSTALLATION OF STRUCTURAL-USE PANELS**
    - a. Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
    - b. Comply with "Code Plus" provisions of above-referenced guide.
    - c. Fastening Methods: Fasten panels as indicated below:
      - 1) Sheathing: Nail to Framing as indicated on contract documents.

8. PROTECTION

- a. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified allow to dry sufficiently to meet moisture content requirement before closing in.

**END OF SECTION 061000**

## SECTION 061753 – SHOP FABRICATED WOOD TRUSSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Wood roof trusses.
  - 2. Wood girder trusses.

#### 1.3 ALLOWANCES

- A. Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing Allowance as specified in Section 012100 "Allowances."

#### 1.4 DEFINITIONS

- A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.
- B. Shop Drawings: Show fabrication and installation details for trusses.
  - 1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
  - 2. Indicate sizes, stress grades, and species of lumber.
  - 3. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
  - 4. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
  - 5. Show splice details and bearing details.
- C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.6 INFORMATIONAL SUBMITTALS

- A. : For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.
- B. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.
- C. Evaluation Reports: For the following, from ICC-ES:
  - 1. Metal-plate connectors.
  - 2. Metal truss accessories.

## 1.7 QUALITY ASSURANCE

- A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.
  - 1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
  - 2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
  - 1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
  - 2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
  - 3. Provide for air circulation around stacks and under coverings.
- B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

## **PART 2 - PRODUCTS**

### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.
- B. Structural Performance: Metal-plate-connected wood trusses shall be capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.
  - a. Roof Trusses: Vertical deflection of 1/240 of span.



- C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.
- D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

## 2.2 DIMENSION LUMBER

- A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Provide dressed lumber, S4S.
  - 3. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

## 2.3 METAL CONNECTOR PLATES

- A. Fabricate connector plates to comply with TPI 1.

## 2.4 FASTENERS

- A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
- B. Nails, Brads, and Staples: ASTM F1667.

## 2.5 METAL FRAMING ANCHORS AND ACCESSORIES

- A. Allowable design loads, as published by manufacturer, shall comply with or exceed those **of basis-of-design products**. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

## 2.6 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

## 2.7 FABRICATION

- A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

- B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.
- C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.
  - 1. Fabricate wood trusses within manufacturing tolerances in TPI 1.
- D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install wood trusses only after supporting construction is in place and is braced and secured.
- B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.
- C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
- D. Install and brace trusses according to TPI recommendations and as indicated.
- E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.
- F. Space trusses **as indicated**; adjust and align trusses in location before permanently fastening.
- G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.
- H. Securely connect each truss ply required for forming built-up girder trusses.
  - 1. Anchor trusses to girder trusses as indicated.
- I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.
- J. Install wood trusses within installation tolerances in TPI 1.
- K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.
- L. Replace wood trusses that are damaged or do not comply with requirements.
  - 1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

### 3.2 REPAIRS AND PROTECTION

- A. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

### 3.3 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

**END OF SECTION 061753**

This page intentionally left blank

## **SECTION 06 2000 FINISH CARPENTRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Finish carpentry items.
- B. Hardware and attachment accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 08 1416 - Flush Wood Doors.
- C. Section 09 9000 - Painting and Coating - Commercial Facility Guide Specification - Sherwin-Williams

#### **1.03 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

#### **1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Protect from moisture damage.

### **PART 2 PRODUCTS**

#### **2.01 FINISH CARPENTRY ITEMS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Woodwork Items:
  - 1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

#### **2.02 LUMBER MATERIALS**

- A. Softwood Lumber: Spruce-pine fir species, suitable for exterior paint finish.

#### **2.03 FASTENINGS**

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.
- C. Fasteners: Of size and type to suit application.
- D. Fasteners for Exterior Applications: Stainless steel; length required to penetrate wood substrate 1-1/2 inch minimum.

#### **2.04 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Lumber for Shimming and Blocking.
- C. Primer: 09 9000 Painting and Coating - Commercial Facility Guide Specification - Sherwin-Williams.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

### **3.02 INSTALLATION**

- A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Install factory-fabricated units in accordance with manufacturer's printed installation instructions.
- C. Set and secure materials and components in place, plumb and level.
- D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

### **3.03 TOLERANCES**

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

**END OF SECTION**

## SECTION 07 1300 SHEET WATERPROOFING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Self-adhered rubberized asphalt sheet membrane.

#### 1.02 REFERENCE STANDARDS

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension 2016 (Reapproved 2021).
- B. ASTM D570 - Standard Test Method for Water Absorption of Plastics 2022.
- C. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems 2018.
- D. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes 2020.
- E. NRCA (WM) - The NRCA Waterproofing Manual 2021.

#### 1.03 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for membrane, flexible flashings, and joint and crack sealants.

#### 1.04 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

#### 1.05 WARRANTY

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Contractor to correct defective Work within period of five years after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
- C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water.

### PART 2 PRODUCTS

#### 2.01 SHEET WATERPROOFING MATERIALS

- A. Self-Adhered Rubberized Asphalt Sheet Membrane:
  - 1. Thickness: 63 mil, 0.061 inch, minimum.
  - 2. Sheet Width: 3.28 feet, minimum.
  - 3. Tensile Strength:
    - a. Membrane: 425 psi, minimum, measured in accordance with ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
  - 4. Elongation at Break: Greater than 200 percent, minimum, measured in accordance with ASTM D412.
  - 5. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
  - 6. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 200 feet head of water applied in accordance with test method ASTM D5385/D5385M.
  - 7. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.

#### 2.02 ACCESSORIES

- A. Seaming Materials: As recommended by membrane manufacturer.
- B. Membrane Sealant: As recommended by membrane manufacturer.

- C. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
- D. Flexible Flashings: Type recommended by membrane manufacturer.
- E. Termination Bars: Aluminum; compatible with membrane and adhesives.
- F. Adhesives: As recommended by membrane manufacturer.
- G. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions are acceptable prior to starting work.
- B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
- C. Verify that items penetrating surfaces to receive waterproofing are securely installed.
- D. Do not proceed with work until unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- C. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.
- D. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.
- E. Prepare building expansion joints at locations as indicated on drawings.
- F. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate in accordance with ASTM D5295/D5295M.
  - 1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
  - 2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in reference standard.
  - 3. Remove and replace areas of defective concrete; see Section 03 3000.
  - 4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in referenced standard.
  - 5. Test concrete surfaces as described in referenced standards, and verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

#### **3.03 INSTALLATION - MEMBRANE**

- A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- B. Roll out membrane, and minimize wrinkles and bubbles.
- C. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
- D. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
- E. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
- F. Install building expansion joints at locations as indicated on drawings.



- G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- H. Seal membrane and flashings to adjoining surfaces.
  - 1. Install termination bar along edges.

#### **3.04 PROTECTION**

- A. Do not permit traffic over unprotected or uncovered membrane.

**END OF SECTION**

This page intentionally left blank

## **SECTION 07 2700 AIR BARRIERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Air barriers.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Air barrier under exterior cladding.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.
- B. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- C. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Shop Drawings: Provide drawings of special joint conditions.

#### **1.05 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

### **PART 2 PRODUCTS**

#### **2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR IMPERMEABLE)**

- A. Air and Vapor Barrier, Fluid-Applied:
  - 1. Air Permeance: 0.0001 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
  - 2. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M using Procedure A - Desiccant Method, at 73.4 degrees F.
  - 3. Complies with NFPA 285 requirements for wall assembly.
  - 4. Seam and Perimeter Tape: As recommended by sheet manufacturer.
  - 5. Products:
    - a. Carlisle Coatings and Waterproofing, Inc: [www.carlisleccw.com/#sle](http://www.carlisleccw.com/#sle).
    - b. GCP Applied Technologies: [www.gcpat.com/#sle](http://www.gcpat.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; ExoAir 120: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 ACCESSORIES**

- A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.
- B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
  - 1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch, nominal thickness.
  - 2. Color: Green.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready for work of this section.
- B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
- C. Do not proceed with this work until unsatisfactory conditions have been corrected.

#### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

#### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Fluid-Applied Coatings or Membranes:
  - 1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
  - 2. Where exterior masonry veneer is being installed, install masonry anchors before installing air barrier over masonry; provide airtight seal around anchors.
  - 3. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.
- E. Openings and Penetrations in Exterior Air Barriers:
  - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  - 2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
  - 3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
  - 4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
  - 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
  - 6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

#### **3.04 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**

**SECTION 07 3113  
ASPHALT SHINGLES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Asphalt shingle roofing.
- B. Flexible sheet membranes for eave protection, underlayment, and valley protection.
- C. Metal flashing.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Roof sheathing.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Edge and cap flashings.

**1.03 REFERENCE STANDARDS**

- A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- B. ASTM D3161/D3161M - Standard Test Method for Wind Resistance of Steep Slope Roofing Products (Fan-Induced Method) 2020.
- C. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules 2019.
- D. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings 2020a.
- E. ASTM F1667/F1667M - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples 2021a.
- F. NRCA (RM) - The NRCA Roofing Manual 2023.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating material characteristics, performance criteria, and limitations.
- C. Shop Drawings: For metal flashings, indicate specially configured metal flashings, jointing methods and locations, fastening methods and locations, and installation details.
- D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern; for color selection.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing asphalt shingles, with at least 5 years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.
- C. When storing roofing materials on roofing system ensure that no damage occurs to supporting members and other materials.

**1.07 FIELD CONDITIONS**

- A. Do not install shingles, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.

## **1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide 50 -year manufacturer's warranty for wind damage.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Asphalt Shingles:
  - 1. Certaineed Roofing; Landmark Premium Shingles: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. GAF: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  - 3. Owens Corning Corp: [www.owenscorning.com/#sle](http://www.owenscorning.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 ASPHALT SHINGLES**

- A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
  - 1. Fire Resistance: Class A, complying with ASTM E108.
  - 2. Wind Resistance: Class A, when tested in accordance with ASTM D3161/D3161M.
  - 3. Self-sealing type.
  - 4. Color: As selected by Architect.

### **2.03 SHEET MATERIALS**

- A. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
  - 1. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
  - 2. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
  - 3. Products:
    - a. Certaineed Roofing; WinterGuard Granular Waterproofing Underlayment: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Substitutions: See Section 01 6000 - Product Requirements.

### **2.04 METAL FLASHING**

- A. Metal Flashing: Aluminum; see Section 07 6200.

### **2.05 ACCESSORIES**

- A. Roofing Nails: Standard round wire shingle type, galvanized steel, minimum 3/8-inch head diameter, 12-gauge, 0.109-inch nail shank diameter, 1-1/2 inches long and complying with ASTM F1667/F1667M.
- B. Bituminous Paint: Acid and alkali resistant type; black color.
- C. Plastic Ridge Vents: Extruded plastic with vent openings that do not permit direct water or weather entry; flanged to receive shingles.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions prior to starting this work.
- B. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.
- C. Verify roof openings are correctly framed.
- D. Verify deck surfaces are dry, free of ridges, warps, or voids.

### **3.02 PREPARATION**

- A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

- B. At areas where eave protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.
- C. Broom clean deck surfaces before installing underlayment or eave protection.
- D. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

### **3.03 INSTALLATION**

- A. Eave Protection Membrane:
  - 1. Install underlayment membrane as eave protection membrane from eave edge to minimum 48 inches up-slope beyond interior face of exterior wall.
- B. Underlayment:
  - 1. Roof Slopes Greater Than 4:12: Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches; stagger end laps of each consecutive layer, nail in place, and weather lap minimum 4 inches over eave protection.
  - 2. At Valleys: Install underlayment minimum 36 inches wide, end lap 6 inches and seal.
  - 3. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.
- C. Valley Protection:
  - 1. Install flexible flashing in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- D. Metal Flashing:
  - 1. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.
  - 2. Secure in place with nails at 6 inches on center, and conceal fastenings.
  - 3. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.
- E. Shingles:
  - 1. Install shingles in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
    - a. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
    - b. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.
  - 2. Place shingles in straight coursing pattern with 5-inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.
  - 3. Project first course of shingles 3/4 inch beyond fascia boards.
  - 4. Extend shingles 1/2 inch beyond face of gable edge fascia boards.
  - 5. Cap hips with individual shingles, maintaining 5-inch weather exposure, and place to avoid exposed nails.
  - 6. Complete installation to provide weathertight service.

### **3.04 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

### **3.05 PROTECTION**

- A. Do not permit traffic over finished roof surface; protect roofing until completion of project.
- B. Touch-up, repair, or replace damaged asphalt shingles or accessories before Date of Substantial Completion.

**END OF SECTION**

This page intentionally left blank



**SECTION 07 4616  
ALUMINUM SIDING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum siding for exterior walls.
- B. Trim, flashings, accessories, and fasteners for aluminum siding.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 2700 - Air Barriers
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings and trim associated with metal siding.
- C. Section 07 9200 - Joint Sealants: Sealing joints between siding, adjacent construction, and fixtures.

**1.03 REFERENCE STANDARDS**

- A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- C. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates 2022.
- D. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films 2007 (Reapproved 2015).

**1.04 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. Preparation instructions and recommendations.
  - 2. Siding materials, underlayment, flashings, fasteners and accessories.
  - 3. Dimensions, physical properties, and typical details.
  - 4. Storage and handling requirements and recommendations.
  - 5. Installation instructions and recommendations.
- C. Shop Drawings: Indicate layout, methods of attachment and support clips, provisions for movement, flashing, trim, edge and field conditions, interface with adjacent materials, locations of cutouts or special shapes, existing construction, \_\_\_\_\_, and details.
- D. Samples: For each finish product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns, including the following:

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Deliver and store products in manufacturer's unopened packaging bearing brand name and manufacturer's identification until ready for installation.

- C. Verify quantities and condition immediately upon receipt; remove damaged materials from site, and coordinate with manufacturer to replace with new materials meeting specified requirements.
- D. Store products off the ground, within manufacturer's temperature and environmental limits, away from moisture, protected from traffic and construction activities, and minimize on-site storage prior to installation.

### **1.07 FIELD CONDITIONS**

- A. Do not install siding when air temperature or relative humidity are outside manufacturer's limits.

### **1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer's warranty on siding and trim accessories finishes to cover the following:
  - 1. Color fading of not more than five Hunter color-difference units when tested in accordance with ASTM D2244.
  - 2. Degree of chalking of six or greater when tested in accordance with ASTM D4214.
  - 3. Cracking, checking, peeling, or failure of paint to adhere to metal substrate.
  - 4. Warranty Period: Based on specific finish system.
    - a. PVDF (Polyvinylidene Fluoride): 30 years.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Aluminum Siding Manufacturers:
  - 1. PAC-CLAD, a Carlisle Corporation; PAC-750 Soffit Full Vent and R-36: [www.pac-clad.com/sle#](http://www.pac-clad.com/sle#).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 ALUMINUM SIDING**

- A. Vertical Aluminum Siding:
  - 1. Factory-formed siding.
  - 2. Precoated aluminum sheet, 0.032 inch minimum base metal thickness.
  - 3. Profile: Corrugated panel, 36 inch exposure.
  - 4. Nailing Hem: Single layer, with 1-1/8 inch elongated nail holes at maximum 1-5/8 inches on center.
  - 5. Length: 10 feet, minimum.
  - 6. Finish: Shop precoated with manufacturer's standard SMP (silicone-modified polyester) coating system.
  - 7. Color: As selected by Architect from manufacturers full range of available colors.
  - 8. Texture: Smooth.
- B. Aluminum Soffit:
  - 1. Material: Precoated aluminum sheet, 0.032 inch, minimum base metal thickness.
  - 2. Profile: Board Style, Double 6-Inch; 6 inches wide, fully vented; 12 inch exposure.
  - 3. Profile: Board Style, Double 6-Inch; 6 inches wide, half vented; 12 inch exposure.
  - 4. Dimensions: 12 inch wide by 25 feet long.
  - 5. Ventilation: Provide manufacturer's standard of net free area.
  - 6. Soffit Accessories: Provide coordinating accessories made of same material as required for complete and proper installation.
    - a. J-Channel trim.
    - b. Roof drip edge, quick start.
    - c. Fascia corner.
    - d. Snap-on frieze trim.

## **2.03 MATERIALS**

- A. Precoated Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper, with smooth surface texture; continuous-coil-coated on exposed surfaces with indicated finish coating, and manufacturer's standard panel back coating.

## **2.04 ACCESSORIES**

- A. Fasteners: Aluminum; nonstaining, of size and strength to securely and rigidly retain this work; prefinished to match siding finish.
- B. Flashing: Aluminum; see Section 07 6200.
- C. Finish: Shop precoated with manufacturer's standard PVDF (polyvinylidene fluoride) coating system.
  - 1. Color: As selected by Architect from manufacturer's full range of available colors.
  - 2. Texture: Smooth.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrate conditions before beginning installation.
- B. Verify dimensions and acceptable substrate condition.
- C. Verify air barrier has been properly installed over substrate; see Section 07 2700.
- D. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.
- E. Do not proceed with installation until unacceptable conditions have been corrected.

### **3.02 PREPARATION**

- A. Surface Preparation: Prepare surfaces as recommended by manufacturer.
- B. Protect surrounding areas and adjacent surfaces during execution of this work.

### **3.03 INSTALLATION**

- A. Install aluminum siding, soffit, trim, and accessories in accordance with manufacturer's written instructions.
- B. Attach siding using manufacturers recommended fasteners, sealants, and adhesives, allowing for thermal expansion.
- C. Exterior Soffit Vents: Install according to manufacturer's written instructions; provide vent area specified.
- D. Vertical Board and Batten: Work from corner to corner; adjust fields as recommended by manufacturer.
- E. Install joint sealants to ensure watertight conditions; see Section 07 9200.
- F. Where dissimilar materials are in contact, prevent galvanic action as recommended by manufacturer.

### **3.04 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Remove grease and oil films, excess joint sealer, handling marks, and other installation debris from aluminum siding, leaving siding clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to material finishes.
- C. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.
- D. Remove excess materials and debris from project site.

**3.05 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**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, counterflashings, gutters, and downspouts.
- B. Sealants for joints within sheet metal fabrications.
- C. Precast concrete splash pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Field fabricated roof curbs.
- B. Section 07 3113 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.
- C. Section 07 4616 - Aluminum Siding.
- D. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free 2007 (Reapproved 2018).
- F. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

**1.04 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.
- C. Samples: Submit two samples 2 by 2 inch in size illustrating metal finish color.

**1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials that could cause discoloration or staining.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Sheet Metal Flashing and Trim Manufacturers:
  - 1. Drexel Metals, A Carlisle Company; [www.drexment.com/#sle](http://www.drexment.com/#sle)
  - 2. Petersen Aluminum Corporation; PAC-CLAD: [www.pac-clad.com/#sle](http://www.pac-clad.com/#sle).
  - 3. Metal Sales Manufacturing Corporation: [www.metalsales.us.com](http://www.metalsales.us.com).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 SHEET MATERIALS**

- A. Pre-Finished Aluminum: ASTM B209/B209M; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with PVDF coating.
  - 1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two coat system including primer and color coat with at least 70 percent PVDF coating.

### **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

### **2.04 GUTTER AND DOWNSPOUT FABRICATION**

- A. Gutters: Profile as indicated.
- B. Downspouts: Rectangular profile.
- C. Accessories: Profiled to suit gutters and downspouts.
  - 1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
- D. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3,000 psi at 28 days, with minimum 5 percent air entrainment.
- E. Seal metal joints.

### **2.05 ACCESSORIES**

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Slip Sheet: Rosin sized building paper.
- C. Primer: Zinc chromate type.
- D. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.
- E. Concealed Sealants: Non-curing butyl sealant.
- F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
  - 1. Manufacturers:
    - a. Pecora; [www.pecora.com](http://www.pecora.com).
    - b. Tremco; [www.tremcosealants.com](http://www.tremcosealants.com).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- G. Plastic Cement: ASTM D4586/D4586M, Type I.
- H. Reglets: Surface mounted type, galvanized steel.
  - 1. Product: Springlock Flashing System with SM Surface Mounted Reglet manufactured by Fry Reglet Corporation.

2. Kynar 500/Hylar 500 finish; Color: As selected by Architect from manufacturer's standard colors.
- I. Reglets: Recessed type, aluminum.
  1. Product: Springlock Flashing System with MA Masonry Reglet manufactured by Fry Reglet Corporation.
  2. Kynar 500/Hylar 500 finish; Color: As selected by Architect from manufacturer's standard colors.

### **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. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

#### **3.03 INSTALLATION**

- A. Comply with drawing details.
- B. 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.
- C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- D. Apply plastic cement compound between metal flashings and felt flashings.
- E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- F. Seal metal joints watertight.
- G. Secure gutters and downspouts in place with fasteners.
- H. Slope gutters 1/4 inch per 10 feet, minimum.
- I. Set splash pads under downspouts.

**END OF SECTION**

This page intentionally left blank



## **SECTION 07 9200 JOINT SEALANTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.
- B. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
- C. Section 08 8000 - Glazing: Glazing sealants and accessories.
- D. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
- E. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants 2017.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- F. ASTM C1311 - Standard Specification for Solvent Release Sealants 2022.
- G. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants 2018.
- H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 4. Substrates the product should not be used on.
- C. Color Cards and Sample Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards and sample cards showing standard colors available for selection.

#### **1.05 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. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

## **PART 2 PRODUCTS**

### **2.01 NONSAG JOINT SEALANTS**

- A. Type One - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
  - 2. Non-Staining to Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
  - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  - 4. Manufacturers:
    - a. Pecora Corporation; Pecora 890 NST (Non-Staining Technology): [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; Sikasil WS-290: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Spectrem 1: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Type Two - Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Color: Match adjacent finished surfaces.
  - 3. Cure Type: Single-component, neutral moisture curing
  - 4. Service Temperature Range: Minus 65 to 180 degrees F.
  - 5. Manufacturers:
    - a. Pecora Corporation; Percora 895: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; Sikasil WS-295: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Spectrem 2: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Type Three - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
  - 1. Color: To suit conditions.
  - 2. Manufacturers:
    - a. Pecora Corporation; Percora 895NST: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; Sikasil GP: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Tremco Commercial Sealants & Waterproofing; Tremsil 200: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- D. Type Four - Tamper-Resistant, Silyl-Terminated Polyether (STPE) and Polyurethane (STPU) Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
  - 1. Hardness Range: 25 to 30, Shore A, when tested in accordance with ASTM C661.
  - 2. Color: To be selected by Architect from manufacturer's standard range.
  - 3. Manufacturers:
    - a. Pecora Corporation; DynaTrol I-XL Hybrid: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Sika Corporation; SikaHyflex-150 LM: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- E. Type Five - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
  - 1. Color: To be selected by Architect from manufacturer's standard range.
  - 2. Manufacturers:
    - a. Pecora Corporation; DynaTrol II: [www.pecora.com/#sle](http://www.pecora.com/#sle).

- b. Sika Corporation; Sikaflex-2c NS: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
  - c. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
- F. Type Six - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
- 1. Color: Standard colors matching finished surfaces, Type OP (opaque).
  - 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
  - 3. Manufacturers:
    - a. Pecora Corporation; AC-20 +Silicone: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Tremco Commercial Sealants & Waterproofing; Tremflex 834: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.
- G. Type Seven - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
- 1. Manufacturers:
    - a. Pecora Corporation; Pecora BC-158 Butyl Rubber Sealant: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Tremco Commercial Sealants & Waterproofing; Tremco Butyl Sealant: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 SELF-LEVELING SEALANTS

- A. Type Eight - Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
- 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
  - 3. Color: To be selected by Architect from manufacturer's standard range.
  - 4. Manufacturers:
    - a. Pecora Corporation; Urexpan NR-200: [www.pecora.com/#sle](http://www.pecora.com/#sle).
    - b. Tremco Commercial Sealants & Waterproofing; THC-901: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - c. Sika Corporation; Sikaflex-2c SL: [www.usa.skia.com/#sle](http://www.usa.skia.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Type Nine - Semi-Self-Leveling Polyurethane Sealant: Intended for expansion joints in sidewalks, swimming pool decks, plazas, floors and other horizontal surfaces with up to 6 percent slope.
- 1. Composition: Single-component.
  - 2. Durometer Hardness, Type A: 35 to 45, minimum, when tested in accordance with ASTM D2240.
  - 3. Color: Gray.
  - 4. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; Vulkem 445 SSL: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
    - b. Sika Corporation; Sikaflex-1c SL: [www.usa.skia.com/#sle](http://www.usa.skia.com/#sle).
    - c. Substitutions: See Section 01 6000 - Product Requirements.

## 2.03 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
- 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.

2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
  3. Open Cell: 40 to 50 percent larger in diameter than joint width.
  4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
  - C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
  - D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
  - E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

#### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

#### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

#### **3.04 FIELD QUALITY CONTROL**

- A. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

#### **3.05 POST-OCCUPANCY**

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

**END OF SECTION**

**SECTION 08 1213  
HOLLOW METAL FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal frames for non-hollow metal doors.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1613 - Fiberglass Doors
- B. Section 08 7100 - Door Hardware: Hardware, silencers, and weatherstripping.
- C. Section 09 9000 - Painting and Coating - Commercial Facility Guide Specification - Sherwin-Williams

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- G. 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 2018a.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete 2020.
- I. ASTM C476 - Standard Specification for Grout for Masonry 2022.
- J. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.
- N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.
- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames 2014.
- P. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames 2019.

**1.04 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.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.

### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store in accordance with applicable requirements and in compliance with standards and/or custom guidelines as indicated.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Hollow Metal Frames:
  - 1. Curries, an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Mesker, dormakaba Group: [www.meskeropeningsgroup.com/#sle](http://www.meskeropeningsgroup.com/#sle).
  - 3. Steelcraft, an Allegion brand: [www.allegion.com/#sle](http://www.allegion.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 PERFORMANCE REQUIREMENTS**

- A. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- B. Accessibility: Comply with ICC A117.1 and ADA Standards.
- C. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- D. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

### **2.03 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS**

- A. Frame Finish: Factory primed and field finished.
- B. Exterior Door Frames: Full profile/continuously welded type.
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
  - 2. Weatherstripping: See Section 08 7100.

### **2.04 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

### **2.05 ACCESSORIES**

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

#### **3.02 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

#### **3.03 INSTALLATION**

- A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.
- B. Coordinate frame anchor placement with wall construction.
- C. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- D. Install door hardware as specified in Section 08 7100.
- E. Coordinate installation of electrical connections to electrical hardware items.
- F. Touch up damaged factory finishes.

#### **3.04 TOLERANCES**

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

**END OF SECTION**

This page intentionally left blank



**SECTION 08 1613  
FIBERGLASS DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fiberglass doors.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1213 - Hollow Metal Frames: Metal frames.
- B. Section 08 7100 - Door Hardware.

**1.03 REFERENCE STANDARDS**

- A. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights 2019c.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.
- C. Shop Drawings: Indicate layout and profiles; include assembly methods.
  - 1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.
  - 2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.
- D. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.
- E. Manufacturer's Qualification Statement.
- F. Installer's Qualification Statement.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer; include detailed terms of warranty.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- B. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.
  - 1. Store at temperature and humidity conditions recommended by manufacturer.
  - 2. Do not use non-vented plastic or canvas shelters.
  - 3. Immediately remove wet wrappers.
- C. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

### **1.08 FIELD CONDITIONS**

- A. Do not install doors until structure is enclosed.
- B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

### **1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty covering materials and workmanship , including degradation or failure due to chemical contact.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Pultruded Fiberglass Reinforced Plastic (FRP) Doors:
  - 1. Special-Lite, Inc; SL-17: [www.special-lite.com/#sle](http://www.special-lite.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 COMPONENTS**

- A. Doors: Fiberglass construction with reinforced core.
  - 1. Type: As indicated on drawings, including swinging doors.
  - 2. Thickness: 1-3/4 inch, nominal.
  - 3. Core Material: Manufacturer's standard core material for application indicated.
  - 4. Construction:
    - a. Pultruded as single monolithic fiberglass reinforced plastic (FRP) panel.
  - 5. Face Sheet Texture: Pebble grain.
  - 6. Door Panel Configuration: As indicated on drawings.
  - 7. Subframe and Reinforcements: Manufacturer's standard materials.
  - 8. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
  - 9. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.
- B. Hollow Metal Frames: See Section 08 1213.

### **2.03 FINISHES**

- A. Abuse resistant engineered surface with protective coating and through-molded color.
  - 1. Panel Texture: Pebble grain.
  - 2. Color: Slate Grey #5572.

### **2.04 HARDWARE**

- A. Door Hardware: See Section 08 7100.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.
- B. Do not begin installation until substrates have been properly prepared.

### **3.02 PREPARATION**

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Clean and prepare substrate in accordance with manufacturer's directions.

- C. Protect adjacent work and finish surfaces from damage during installation.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.
- B. Install exterior doors in accordance with ASTM E2112.
- C. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.
- D. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.
- E. Repair or replace damaged installed products.

### **3.04 ADJUSTING**

- A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.
- B. Adjust hardware for smooth and quiet operation.
- C. Adjust doors to fit snugly and close without sticking or binding.

### **3.05 CLEANING**

- A. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance.

### **3.06 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION**

This page intentionally left blank

**SECTION 08 3613  
SECTIONAL DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Overhead sectional doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Rough wood framing for door opening.
- B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- B. DASMA 102 - American National Standard Specifications for Sectional Doors 2018.
- C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).
- D. NEMA MG 1 - Motors and Generators 2021.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least five years documented experience.

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Sectional Doors:
  - 1. Raynor Garage Doors: [www.raynor.com/#sle](http://www.raynor.com/#sle).
  - 2. Overhead Door Corporation; Model 416: [www.overheaddoor.com/#sle](http://www.overheaddoor.com/#sle).

**2.02 STEEL DOORS**

- A. Steel Doors: Flush steel, uninsulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.

1. Door Nominal Thickness: 2 inches thick.
  2. Exterior Finish: Factory finished with polyester baked enamel; white color.
  3. Electric Operation: Electric control station.
- B. Door Panels: Steel construction; outer steel sheet of 16 gauge, 0.0598 inch minimum thickness, flush profile; center and end stiles of 16 gauge steel, rabbeted weather joints at meeting rails.

### **2.03 COMPONENTS**

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 2 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.
- B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.
- C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
- D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
- E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
- F. Head Weatherstripping: EPDM rubber seal, one piece full length.
- G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
- H. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.

### **2.04 MATERIALS**

- A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

### **2.05 ELECTRIC OPERATION**

- A. Electric Operators:
1. Mounting: Side mounted on cross head shaft.
  2. Motor Enclosure:
    - a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.
  3. Motor Rating: 1/2 hp; continuous duty.
  4. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
  5. Controller Enclosure: NEMA 250, Type 1.
  6. Opening Speed: 12 inches per second.
  7. Brake: Adjustable friction clutch type, activated by motor controller.
  8. Manual override in case of power failure.
- B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.
- C. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
1. 24 volt circuit.
  2. Surface mounted, at interior door jamb.
  3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
    - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

- D. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.
- E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.
- B. Verify that electric power is available and of the correct characteristics.

#### **3.02 PREPARATION**

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

#### **3.03 INSTALLATION**

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.
- C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

#### **3.04 TOLERANCES**

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

#### **3.05 ADJUSTING**

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.

#### **3.06 CLEANING**

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

#### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

**END OF SECTION**

This page intentionally left blank



**SECTION 08 5659  
SERVICE AND TELLER WINDOW UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Service and teller window units.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 2700 - Air Barriers
- B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.
- C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver units in manufacturer's original packaging and unopened containers with identification labels intact.
- B. Store units in area protected from exposure to weather and vandalism.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within five years from Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Service and Teller Window Units:
  - 1. Quikserv Corp: [www.quikserv.com/#sle](http://www.quikserv.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 SERVICE AND TELLER WINDOW UNITS

- A. Products:
  - 1. Quikserv Corp; T1-2436S Ticket Window with speak-thru and built-in deal tray: [www.quikserv.com/#sle](http://www.quikserv.com/#sle).
    - a. Location: Ticket Booth.
    - b. Quantity: Two (2).
    - c. Operation: Fixed, recessed deal tray with flipped lid and speak through portal.
    - d. Glazing: 1/4" tempered safety glass, clear.
  - 2. Quikserv Corp; SC-4030 Side Sliding Transaction Window: [www.quikserv.com/#sle](http://www.quikserv.com/#sle).
    - a. Location: Concession Stand.
    - b. Quantity: Five (5).
    - c. Operation: Side sliding with automatic closing and locking.
    - d. Glazing: 1/4" tempered safety glass, clear.

## 2.03 ASSEMBLY COMPONENTS

- A. Windows: Factory-fabricated, finished, and glazed, with extruded aluminum frame and glazing stops; complete with hardware and anchors.
  - 1. Provide window units that are re-glazable from the secure side without dismantling the non-secure side of framing.
  - 2. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof. Fully weld corners.
  - 3. Apply factory finish to exposed surfaces.
  - 4. Wind Design: Design and size components to withstand dead loads and live loads caused by pressure and negative wind loads acting normal to plane of window as calculated in accordance with applicable code.

## 2.04 MATERIALS

- A. Aluminum Extrusions: Minimum 1/8 inch thick frame and sash material complying with ASTM B221 and ASTM B221M.
- B. Stainless Steel: Type 304 with No. 3 - Coarse finish.
- C. Monolithic Glass: Fully tempered float glass; minimum 1/4 inch thickness.
- D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

## 2.05 FINISHES

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

## 2.06 ACCESSORIES

- A. Speak-Through Portal: Heavy duty, non-electric, stainless steel unit.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that window openings are ready for installation of windows.
- B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.
- C. Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install units in correct orientation (inside/outside or secure/non-secure).
- C. Anchor units securely in manner so as to achieve performance specified.

- D. Set sill members and sill flashing in continuous bead of sealant.
- E. Separate metal members from concrete and masonry using bituminous paint or with products recommended in writing by the manufacturer for this purpose.
- F. Remove and replace defective work.

**3.03 ADJUSTING**

- A. Adjust operating components for smooth operation while also maintaining a secure, weather-tight enclosure and a tight fit at the contact points; lubricate operating hardware.

**3.04 CLEANING**

- A. Remove protective material from factory finished surfaces.
- B. Clean exposed surfaces promptly after installation without damaging finishes.

**3.05 PROTECTION**

- A. Provide temporary protection to ensure that service and teller windows are without damage upon Date of Substantial Completion.

**END OF SECTION**

This page intentionally left blank

**SECTION 08 7100  
DOOR HARDWARE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Hardware for FRP doors.
- B. Thresholds.
- C. Weatherstripping and gasketing.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 2000 - Finish Carpentry: Wood door frames.
- B. Section 07 9200 - Joint Sealants: Sealants for setting exterior door thresholds.
- C. Section 08 1213 - Hollow Metal Frames.
- D. Section 08 1613 - Fiberglass Doors.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. BHMA A156.4 - Door Controls - Closers 2019.
- C. BHMA A156.6 - Standard for Architectural Door Trim 2021.
- D. BHMA A156.7 - Template Hinge Dimensions 2016.
- E. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.
- F. BHMA A156.16 - Auxiliary Hardware 2018.
- G. BHMA A156.18 - Materials and Finishes 2020.
- H. BHMA A156.21 - Thresholds 2019.
- I. BHMA A156.22 - Standard for Gasketing 2021.
- J. BHMA A156.36 - Auxiliary Locks 2020.
- K. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.
- L. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
- M. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- N. ITS (DIR) - Directory of Listed Products Current Edition.
- O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
  - 1. Architect.
  - 2. Installer's Architectural Hardware Consultant (AHC).
  - 3. Hardware Installer.
  - 4. Owner's Security Consultant.
- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- E. Keying Requirements Meeting:

1. Schedule meeting at project site prior to Contractor occupancy.
2. Attendance Required:
  - a. Contractor.
  - b. Owner.
  - c. Architect.
  - d. Installer's Architectural Hardware Consultant (AHC).
  - e. Hardware Installer.
  - f. Owner's Security Consultant.
3. Agenda:
  - a. Establish keying requirements.
  - b. Verify locksets and locking hardware are functionally correct for project requirements.
  - c. Verify that keying and programming complies with project requirements.
  - d. Establish keying submittal schedule and update requirements.
4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
  - a. Schematic diagram of preliminary key system.
  - b. Flow of traffic and extent of security required.
5. Record minutes and distribute copies via e-mail within two days after meeting to participants and to those affected by decisions made.
6. Deliver established keying requirements to manufacturers.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
  1. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
  2. List groups and suffixes in proper sequence.
  3. Provide complete description for each door listed.
  4. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
  5. Include account of abbreviations and symbols used in schedule.
- D. Samples for Verification:
  1. Submit minimum size of 2 by 4 inch for sheet samples, and minimum length of 4 inch for other products.
  2. Submit product description with samples.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
  1. Submit manufacturer's parts lists and templates.
- G. Keying Schedule:
  1. Submit one copy of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

- I. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- J. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Lock Cylinders: One for each master keyed group.
  - 3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

### **1.06 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least five years of documented experience.
- B. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

### **1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
  - 1. Closers: Ten years, minimum.
  - 2. Exit Devices: Five years, minimum.
  - 3. Locksets and Cylinders: Three years, minimum.
  - 4. Other Hardware: Two years, minimum.

## **PART 2 PRODUCTS**

### **2.01 DESIGN AND PERFORMANCE CRITERIA**

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
  - 1. Applicable provisions of federal, state, and local codes.
  - 2. Accessibility: ADA Standards and ICC A117.1.
  - 3. Auxiliary Hardware: BHMA A156.16.
  - 4. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
- D. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule on drawings.
- E. Fasteners:
  - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
    - a. Aluminum fasteners are not permitted.
    - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.

### **2.02 CONTINUOUS HINGES**

- A. Manufacturers:
  - 1. Ives, an Allegion brand; XY Series: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  - 2. Substitutions: See Section 01 6000-Product Requirements.
- B. Continuous Hinges: Comply with BHMA A156.26.

1. Provide continuous hinges on every exterior door.

### **2.03 LOCK CYLINDERS**

- A. Manufacturers:
  1. Schlage; an Allegion company ; IE72: [us.allegion.com](http://us.allegion.com).
- B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
  1. Provide cylinders from same manufacturer as locking device.

### **2.04 MORTISE LOCKS**

- A. Manufacturers:
  1. Basis of Design: Schlage, an Allegion brand; L9050BDC 07A L283-711: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
  2. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Best, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
  1. Latchbolt Throw: 3/4 inch, minimum.
  2. Deadbolt Throw: 1 inch, minimum.
  3. Backset: 2-3/4 inch unless otherwise indicated.
  4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    - a. Finish: To match lock or latch.

### **2.05 AUXILIARY LOCKS (DEADLOCKS)**

- A. Manufacturers:
  1. Basis of Design: Schlage; an Allegion company ; L463BDC: [us.allegion.com](http://us.allegion.com).
  2. Yale; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  3. Best, dormakaba Group: [www.bestaccess.com/#sle](http://www.bestaccess.com/#sle).
- B. Auxiliary Locks (Deadlocks): Comply with BHMA A156.36, Grade 1.
  1. Type: Mortise.
  2. Application: Mortised.
  3. Backset: 2-3/4 inch, unless otherwise indicated.
  4. Bolt Throw: 1/2 inch, with latch made of hardened steel.
  5. Provide strike that matches frame.

### **2.06 DOOR PULLS AND PUSH PLATES**

- A. Manufacturers:
  1. Rockwood; an Assa Abloy Group company; 110X73C/73CL: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Door Pulls and Push Plates: Comply with BHMA A156.6.
  1. Pull Type: Straight, unless otherwise indicated.
  2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
    - a. Edges: Beveled, unless otherwise indicated.
  3. Material: Stainless steel, unless otherwise indicated.

### **2.07 CLOSERS**

- A. Manufacturers; Surface Mounted:
  1. Basis of Design: LCN, an Allegion brand; Series 4100: [www.allegion.com/us/#sle](http://www.allegion.com/us/#sle).
- B. Closers: Comply with BHMA A156.4, Grade 1.
  1. Type: Surface mounted to door.
  2. Provide hold open feature and limit stop where indicated on door schedule.
  3. At outswinging exterior doors, mount closer on interior side of door.



## 2.08 KICK PLATES

- A. Manufacturers:
  - 1. Rockwood; an Assa Abloy Group company; Product #1050: [www.assaabloydss.com/#sle..](http://www.assaabloydss.com/#sle..)
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
  - 1. Size: 10 inch high by 2 inch less door width (LDW) on push side of door.

## 2.09 THRESHOLDS

- A. Manufacturers:
  - 1. National Guard Products, Inc; 426: [www.ngpinc.com/#sle](http://www.ngpinc.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thresholds: Comply with BHMA A156.21.
  - 1. Provide threshold at each exterior door, unless otherwise indicated.
  - 2. Type: Flat surface.
  - 3. Material: Aluminum.
  - 4. Threshold Surface: Fluted horizontal grooves across full width.
  - 5. Field cut threshold to profile of frame and width of door sill for tight fit.
  - 6. Provide non-corroding fasteners at exterior locations.

## 2.10 WEATHERSTRIPPING

- A. Manufacturers:
  - 1. National Guard Products, Inc; 170NDKB: [www.ngpinc.com/#sle](http://www.ngpinc.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Weatherstripping: Comply with BHMA A156.22.
  - 1. Head and Jamb Type: Self-adhesive.
  - 2. Door Sweep Type: Encased in retainer.
  - 3. Material: Aluminum, with neoprene weatherstripping.
  - 4. Provide weatherstripping on each exterior door at head, jambs, unless otherwise indicated; .
  - 5. Provide door bottom sweep on each exterior door, unless otherwise indicated.

## 2.11 SILENCERS

- A. Manufacturers:
  - 1. Rockwood; an Assa Abloy Group company: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
  - 1. Single Door: Provide three on strike jamb of frame.
  - 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
  - 3. Material: Rubber, gray color.

## 2.12 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
  - 1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
  - 2. Exceptions:
    - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
    - b. Hinges for Fire-Rated Doors: Steel base material with plated finish, in compliance with NFPA 80.

- c. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
- d. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

#### **3.02 INSTALLATION**

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Use templates provided by hardware item manufacturer.
- D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
  - 1. For Steel Door Frames: See Section 08 1213.
  - 2. Mounting heights in compliance with ADA Standards:
    - a. Push Plates/Pull Bars: 42 inch.
    - b. Deadlocks (Deadbolts): 48 inch.
- E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

#### **3.03 ADJUSTING**

- A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

#### **3.04 CLEANING**

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.
- D. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

#### **3.05 PROTECTION**

- A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

**END OF SECTION**

**SECTION 09 2116  
GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal stud wall framing.
- B. Metal channel ceiling framing.
- C. Gypsum wallboard.
- D. Joint treatment and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

**1.03 REFERENCE STANDARDS**

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- C. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing 2003 (Reapproved 2017).
- D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- G. 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 2022.
- H. 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 2022.
- I. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- J. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- K. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

**1.04 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.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.
- B. Copies of Documents at Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

## **PART 2 PRODUCTS**

### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

### **2.02 METAL FRAMING MATERIALS**

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. ClarkDietrich; \_\_\_\_\_: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
  - 1. Studs: C-shaped with knurled or embossed faces.
  - 2. Runners: U shaped, sized to match studs.
  - 3. Ceiling Channels: C-shaped.
  - 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
- C. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
- D. Non-structural Framing Accessories:
  - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
  - 2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.

### **2.03 BOARD MATERIALS**

- A. Manufacturers - Gypsum-Based Board:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. National Gypsum Company: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  - 3. USG Corporation: [www.usg.com/#sle](http://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. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  - 3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 1/2 inch.
  - 4. Paper-Faced Products:
    - a. USG Corporation; USG Sheetrock Brand Firecode X Panels: [www.usg.com/#sle](http://www.usg.com/#sle).

### **2.04 GYPSUM WALLBOARD ACCESSORIES**

- A. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.
- B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- C. Fasteners and Adhesives: Products recommended by gypsum board manufacturer.
- D. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- E. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

- F. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- G. Adhesive for Attachment to Wood, ASTM C557 and Metal.

### **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.
  - 1. Level ceiling system to a tolerance of 1/1200.
  - 2. Laterally brace entire suspension system.
  - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center.
  - 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 extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
  - 1. Orientation: Vertical.
- F. Blocking: Install wood blocking for support of:
  - 1. Framed openings.

#### **3.03 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 in most economical direction, with ends and edges occurring over firm bearing.
- 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. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Installation on Metal Framing: Use screws for attachment of gypsum board.

#### **3.04 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

#### **3.05 JOINT TREATMENT**

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. 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.
  2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
  3. Taping, filling, and sanding are not required at base layer of double-layer applications.

### **3.06 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

**END OF SECTION**

**SECTION 09 9000  
PAINTING AND COATING - COMMERCIAL FACILITY GUIDE SPECIFICATION - SHERWIN-  
WILLIAMS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Interior painting and coating systems.
- C. Exterior painting and coating systems.
- D. Scope:
  - 1. Finish surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
    - a. Exterior:
      - 1) Metal, Miscellaneous: Iron, ornamental iron, structural iron and steel, ferrous metal.
    - b. Interior:
      - 1) Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
      - 2) Metal: Hollow metal frames
      - 3) Drywall: Walls, ceilings, gypsum board, and similar items.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

**1.03 REFERENCE STANDARDS**

- A. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- B. SSPC-SP 6 - Commercial Blast Cleaning 2007.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Product characteristics.
  - 2. Surface preparation instructions and recommendations.
  - 3. Primer requirements and finish specification.
  - 4. Storage and handling requirements and recommendations.
  - 5. Application methods.
  - 6. Clean-up information.
- C. Samples: Submit four paper draw down samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

**1.05 QUALITY ASSURANCE**

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, product name, product code, color designation, VOC content, batch date, environmental handling, surface preparation, application, and use instructions.

- C. Paint Materials: Store at a minimum of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

### **1.07 FIELD CONDITIONS**

- A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.
- B. Follow manufacturer's recommended procedures for producing the best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Basis of Design Products: Subject to compliance with requirements, provide Sherwin-Williams Company (The) products indicated; [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- B. Comparable Products: Products of approved manufacturers will be considered in accordance with 01 6000 - Product Requirements, and the following:
  - 1. Other Acceptable Manufacturers:
    - a. Benjamin Moore & Co.; [www.benjaminmoore.com](http://www.benjaminmoore.com).
    - b. PPG Paints; [www.ppgpaints.com](http://www.ppgpaints.com).
    - c. Approved Substitute.

### **2.02 PAINTINGS AND COATINGS**

- A. General:
  - 1. Provide factory-mixed coatings unless otherwise indicated.
  - 2. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.
- B. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- C. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

### **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Metal, Miscellaneous: Iron, ornamental iron, structural iron and steel, ferrous metal.
  - 1. Latex Systems:
    - a. Gloss Finish:
      - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).  
(a) 5 to 10 mils wet, 1.8 to 3.6 mils dry per coat.
      - 2) 2nd and 3rd Coats: Sherwin-Williams Pro Industrial Acrylic Gloss, B66-600 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).  
(a) 2 to 4 mils dry per coat.

### **2.04 PAINT SYSTEMS - INTERIOR**

- A. Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
  - 1. Epoxy Systems, Water Based:
    - a. Semi-Gloss Finish:
      - 1) 1st Coat: Sherwin-Williams Loxon Block Surfacers, LX01W200: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).  
(a) 50 to 100 sq ft/gal.
      - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).  
(a) 4 mils wet, 1.5 mils dry per coat.
- B. Metal: Hollow metal frames.
  - 1. Epoxy Systems, Water Based:



- a. Gloss Finish:
  - 1) 1st Coat: Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1310 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - (a) 5 mils wet, 2 mils dry per coat.
  - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Water Based Catalyzed Epoxy, B73-300 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
    - (a) 5 mils wet, 2 mils dry per coat.
- C. Drywall: Walls, ceilings, gypsum board, and similar items.
  - 1. Epoxy Systems, Water Based:
    - a. Semi-Gloss Finish:
      - 1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
        - (a) 4 mils wet, 1.5 mils dry per coat.
      - 2) 2nd and 3rd Coat: Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, K46 Series: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
        - (a) 4 mils wet, 1.5 mils dry per coat.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Masonry: Remove efflorescence and chalk.
- D. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.
- E. Galvanized Surfaces:
  - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- F. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Prime bare steel surfaces.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended by paint manufacturer and blast cleaning according to SSPC-SP 6. Protect from corrosion until coated.

#### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions.
- C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.
- D. Regardless of number of coats specified, apply additional coats until complete hide is achieved.

### **3.04 PRIMING**

- A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to top coat manufacturers.

### **3.05 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

### **3.06 PROTECTION**

- A. Protect finished coatings from damage until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**END OF SECTION**

**SECTION 09 9600  
HIGH-PERFORMANCE COATINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. High performance coatings.
- B. Surface preparation.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

**1.03 REFERENCE STANDARDS**

- A. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- C. SSPC-SP 13 - Surface Preparation of Concrete 2018.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide complete list of all products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
- C. Samples: Submit two samples 6 by 6 inch in size illustrating colors available for selection.
- D. Maintenance Data: Include cleaning procedures and repair and patching techniques.

**1.05 QUALITY ASSURANCE**

- A. Maintain one copy of each referenced document that applies to application on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
- C. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

**1.07 FIELD CONDITIONS**

- A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- B. Do not install materials when temperature is below 50 degrees F or above 100 degrees F.
- C. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.
- D. Do not install materials when relative humidity is above 85%.

- E. Restrict traffic from area where coating is being applied or is curing.

#### **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. Warranty: Include coverage for bond to substrate.

### **PART 2 PRODUCTS**

#### **2.01 HIGH-PERFORMANCE COATINGS**

- A. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:
  - 1. Abrasion Resistance: 150 mg loss, when tested in accordance with ASTM D4060.
  - 2. Impact Resistance: 100 in.lb., when tested in accordance with ASTM D2794.
  - 3. Hardness: H, when tested in accordance with ASTM D3363.
  - 4. Adhesion: 550 psi concrete, when tested in accordance with ASTM D4541.

#### **2.02 TOP COAT MATERIALS**

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
  - 1. Volatile Organic Compound (VOC) Content: Comply with Section 01 6116.
- B. Epoxy Floor Coating:
  - 1. Number of Coats: Two.
  - 2. Product Characteristics:
    - a. Percentage of solids by volume, 41%, minimum.
    - b. Dry film thickness, per coat, 2.0 mils, minimum.
  - 3. Top Coat(s): Epoxy Polysiloxane, Two-Component.
    - a. Sheen: Gloss.
    - b. Products:
      - 1) Sherwin-Williams; ArmorSeal 8100 Water Based Epoxy Floor Coating:  
[www.protective.sherwin-williams.com/#sle..](http://www.protective.sherwin-williams.com/#sle..)
      - 2) Substitutions: Section 01 6000 - Product Requirements.
  - 4. Primer: As recommended by coating manufacturer for specific substrate.
- C. Shellac: Pure, white type.

#### **2.03 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Do not begin application of coatings until substrates have been properly prepared.
- C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
- D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Concrete Floors and Traffic Surfaces: 8 percent.

- F. Proceed with coating application only after unacceptable conditions have been corrected.
  - 1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

### **3.02 PREPARATION**

- A. Clean surfaces of loose foreign matter.
- B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
- C. Remove finish hardware, fixture covers, and accessories and store.
- D. Concrete:
  - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  - 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
  - 3. Clean concrete according to ASTM D4258. Allow to dry.
  - 4. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.
- E. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

### **3.03 PRIMING**

- A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.
- B. Concrete: Prior to priming, patch with masonry filler to produce smooth surface.

### **3.04 COATING APPLICATION**

- A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".
- B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

### **3.05 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
- B. Clean surfaces immediately of overspray, splatter, and excess material.
- C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.
- D. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

### **3.06 PROTECTION**

- A. Protect finished work from damage.

**END OF SECTION**

This page intentionally left blank

**SECTION 10 1100  
VISUAL DISPLAY UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Porcelain enamel steel markerboards.

**1.02 REFERENCE STANDARDS**

- A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling 2018.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard and trim.
- C. Maintenance Data: Include data on regular cleaning, stain removal .

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

**1.05 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year warranty for markerboard and tackboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. EVERWhite; [www.everwhiteboards.com/#sle](http://www.everwhiteboards.com/#sle)
- B. Claridge Products and Equipment, Inc: [www.claridgeproducts.com/#sle](http://www.claridgeproducts.com/#sle).
- C. Polyvision Corporation: [www.polyvision.com/#sle](http://www.polyvision.com/#sle).
- D. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 VISUAL DISPLAY UNITS**

- A. Porcelain Enamel Steel Markerboards:
  - 1. Color: White.
  - 2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch .
  - 3. Magnetic dry erase surfaces.
  - 4. Size: As indicated on drawings.
  - 5. Frame: Extruded aluminum, with concealed fasteners.
  - 6. Frame Finish: Anodized, natural.
  - 7. Accessories: Provide magnetized marker and eraser holder.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.

**3.02 PREPARATION**

- A. Acclimatize tackable wall panels by removing from packaging in installation area not less than 24 hours before application.
- 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 boards in accordance with manufacturer's instructions.

- B. Secure units level and plumb.

**3.04 CLEANING**

- A. Clean board surfaces in accordance with manufacturer's instructions.
- B. Cover with protective cover, taped to frame.
- C. Remove temporary protective cover at Date of Substantial Completion.

**END OF SECTION**



## SECTION 10 1400 SIGNAGE

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Room and door signs.

#### 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 - 2010 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. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. Submit for approval by Owner through Architect prior to fabrication.

#### 1.04 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.

#### 1.05 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. Flat Signs:
  - 1. Best Sign Systems, Inc: [www.bestsigns.com/#sle](http://www.bestsigns.com/#sle).
  - 2. Rowmark: [www.rowmark.com/#sle](http://www.rowmark.com/#sle).
  - 3. Kroy Sign Systems; ADA Signs-Raster Braille: [www.kroysignsystems.com/sle#](http://www.kroysignsystems.com/sle#).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

#### 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. Sign Type: Flat signs with panel media as specified.
  - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
  - 3. Character Height: 1 inch minimum.
  - 4. Sign Size: 6 x 6 inches
  - 5. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.

### **2.03 SIGN TYPES**

- A. Flat Signs: Laminated plastic 1/8 inch thick, matte acrylic.
  - 1. Edges: Square.
  - 2. Corners: Radiused.
  - 3. Wall Mounting of One-Sided Signs: Concealed screws.
- B. Color and Font: Unless otherwise indicated:
  - 1. Character Font: Helvetica, Arial, or other sans serif font.
  - 2. Character Case: Upper case only.
  - 3. Background Color: As selected from manufacturer's standard range.
  - 4. Character Color: White color.
  - 5. Braille: Grade 2 Clear

### **2.04 ACCESSORIES**

- A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.
- B. Tape Adhesive: Double sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**END OF SECTION**

**SECTION 10 2113.19  
PLASTIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Solid plastic toilet compartments.
- B. Urinal screens.

**1.02 RELATED REQUIREMENTS**

- A. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

**1.03 REFERENCE STANDARDS**

- A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Solid Plastic Toilet Compartments:
  - 1. Scranton Products; Hiny Hiders Partitions: [www.scrantonproducts.com/#sle](http://www.scrantonproducts.com/#sle).
  - 2. Substitutions: Section 01 6000 - Product Requirements.

**2.02 PLASTIC TOILET COMPARTMENTS**

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted unbraced.
  - 1. Color: As indicated on drawings
  - 2. Doors:
    - a. Thickness: 1 inch.
    - b. Width: 24 inch.
    - c. Width for Handicapped Use: 36 inch, out-swinging.
    - d. Height: 55 inch.
  - 3. Panels:
    - a. Thickness: 1 inch.
    - b. Height: 55 inch.
  - 4. Pilasters:
    - a. Thickness: 1 inch.
    - b. Width: As required to fit space; minimum 3 inch.
  - 5. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

**2.03 ACCESSORIES**

- A. Pilaster Shoes: Plastic, to match compartments, 3 inches high; concealing floor fastenings.
  - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Extruded aluminum, anti-grip profile.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
  - 1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.
- E. Hinges: Stainless steel, manufacturer's standard finish.
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
  - 1. Door Latch: Slide type with exterior emergency access feature.
  - 2. Door Strike and Keeper with Rubber Bumper: Mount on pilaster in alignment with door latch.
  - 3. Provide door pull for outswinging doors.
- G. Coat Hook: One per compartment, mounted on door.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated on shop drawings.
- B. Verify correct spacing of and between plumbing fixtures.

#### **3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

#### **3.03 TOLERANCES**

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

#### **3.04 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

**END OF SECTION**

**SECTION 10 2800  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Diaper changing stations.

**1.02 RELATED REQUIREMENTS**

- A. Section 10 2113.19 - Plastic Toilet Compartments.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM C1036 - Standard Specification for Flat Glass 2021.
- C. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2022.
- D. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

**PART 2 PRODUCTS**

**2.01 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.

**2.02 COMMERCIAL TOILET ACCESSORIES**

- A. Toilet Paper Dispenser: Single roll, surface mounted black plastic, for coreless type rolls.
  - 1. Products:
    - a. Georgia-Pacific Professional; Softpull Toilet Dispenser Single Roll Smoke: [www.blue-connect.com/#sle](http://www.blue-connect.com/#sle).
- B. Paper Towel Dispenser: Manual, roll paper type.
  - 1. Cover: Black, Plastic.
  - 2. Paper Discharge: Touchless Paper Towel Dispensing.
  - 3. Capacity: 8-inch diameter roll.
  - 4. Mounting: Surface mounted.
  - 5. Products:
    - a. Kimberly-Clark Professional; Sanitouch Hard Roll Towel Dispenser: [www.kcprofessional.com/#sle](http://www.kcprofessional.com/#sle).
- C. Waste Receptacle: Wall-mounted, stainless steel, , continuously welded construction.
  - 1. Liner: Removable, heavy-duty vinyl liner with u-shaped 20-gauge support strap.
  - 2. Products:
    - a. Bobrick; B-277: [www.bobrick.com/#sle](http://www.bobrick.com/#sle).
    - b. Substitutions: Section 01 6000 - Product Requirements.
- D. Soap Dispenser: Soap lather dispenser, wall-mounted, surface, with durable ABS cover; push type soap valve, and window gauge refill indicator, tumbler lock.
  - 1. Minimum Capacity: 34 ounces.
  - 2. Products:
    - a. Impact Products; Foam-eeze Bulk Foam Soap Dispenser with Refill Bottle: [www.impact-products.com/#sle](http://www.impact-products.com/#sle).

- E. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
  - 1. Size: 18" x 60".
  - 2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
  - 3. Products:
    - a. Bobrick; B-165: [www.bobrick.com/#sle](http://www.bobrick.com/#sle).
    - b. Substitutions: Section 01 6000 - Product Requirements.
- F. Grab Bars: Stainless steel, peened surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Length and Configuration: As indicated on drawings.
      - 1) 18", 36", and 42" conformed to code requirements.
    - d. Products:
      - 1) Bobrick; B-5806.99: [www.bobrick.com/#sle](http://www.bobrick.com/#sle).
      - 2) Substitutions: Section 01 6000 - Product Requirements.
- G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted.
  - 1. Products:
    - a. Bobrick; B-270: [www.bobrick.com/#sle](http://www.bobrick.com/#sle).
    - b. Substitutions: Section 01 6000 - Product Requirements.

### **2.03 DIAPER CHANGING STATIONS**

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
  - 1. Material: Polypropylene.
  - 2. Mounting: Surface.
  - 3. Color: Gray.
  - 4. Minimum Rated Load: 50 pounds.
  - 5. Products:
    - a. Koala Kare Products; KB300 Horizontal Surface Mounted: [www.koalabear.com/sle#](http://www.koalabear.com/sle#).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

### **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 in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations, refer to drawings.

### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

### 3.05 SCHEDULE

- A. Womens Restroom - 104
  - Grab Bar 18" - Quantity 1
  - Grab Bar 36" - Quantity 1
  - Grab Bar 42" - Quantity 3
  - Mirror - Quantity 3
  - Waste Receptacle - Quantity 2
  - Napkin Disposal - Quantity 7
  - Soap Dispenser - Quantity 2
  - Paper Towel Dispenser - Quantity 2
  - Toilet Tissue Dispenser - Quantity 7
  - Wall Mounted Changing Table - Quantity 1
- B. Mens Restroom - 101
  - Grab Bar 18" - Quantity 1
  - Grab Bar 36" - Quantity 1
  - Grab Bar 42" - Quantity 3
  - Mirror - Quantity 3
  - Waste Receptacle - Quantity 2
  - Soap Dispenser - Quantity 2
  - Paper Towel Dispenser - Quantity 2
  - Toilet Tissue Dispenser - Quantity 4
  - Wall Mounted Changing Table - Quantity 1
- C. Locker Room Restroom - 107
  - Grab Bar 18" - Quantity 1
  - Grab Bar 36" - Quantity 1
  - Grab Bar 42" - Quantity 1
  - Mirror - Quantity 2
  - Waste Receptacle - Quantity 2
  - Napkin Disposal - Quantity 2
  - Soap Dispenser - Quantity 1
  - Paper Towel Dispenser - Quantity 2
  - Toilet Tissue Dispenser - Quantity 2
- D. Locker Room Restroom - 201
  - Grab Bar 18" - Quantity 1
  - Grab Bar 36" - Quantity 1
  - Grab Bar 42" - Quantity 1
  - Mirror - Quantity 2
  - Waste Receptacle - Quantity 1
  - Napkin Disposal - Quantity 1
  - Soap Dispenser - Quantity 1
  - Paper Towel Dispenser - Quantity 1
  - Toilet Tissue Dispenser - Quantity 1
- E. Women's Restroom - 203
  - Grab Bar 18" - Quantity 1
  - Grab Bar 36" - Quantity 1
  - Grab Bar 42" - Quantity 1
  - Mirror - Quantity 2
  - Waste Receptacle - Quantity 1
  - Napkin Disposal - Quantity 2
  - Soap Dispenser - Quantity 1

Paper Towel Dispenser - Quantity 1  
Toilet Tissue Dispenser - Quantity 2

F. Men's Restroom -204

Grab Bar 18" - Quantity 1  
Grab Bar 36" - Quantity 1  
Grab Bar 42" - Quantity 1  
Mirror - Quantity 2  
Waste Receptacle - Quantity 1  
Soap Dispenser - Quantity 1  
Paper Towel Dispenser - Quantity 1  
Toilet Tissue Dispenser - Quantity 1

**END OF SECTION**



**SECTION 20 05 00 - MECHANICAL GENERAL REQUIREMENTS**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 INDUSTRY STANDARDS ..... 1  
1.04 PERFORMANCE REQUIREMENTS ..... 2  
1.05 QUALITY ASSURANCE ..... 2  
1.06 CODES, PERMITS AND FEES ..... 2  
1.07 DRAWINGS ..... 2  
1.08 MATERIAL AND EQUIPMENT MANUFACTURERS ..... 3  
1.09 INSPECTION OF SITE ..... 3  
1.10 ITEMS REQUIRING PRIOR APPROVAL ..... 3  
1.11 SUBMITTALS ..... 4  
1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS ..... 4  
1.13 RECORD DRAWINGS ..... 5  
1.14 INSTRUCTION OF OWNER PERSONNEL ..... 5  
1.15 WARRANTY ..... 5  
PART 2 PRODUCTS (NOT APPLICABLE) ..... 5  
PART 3 EXECUTION ..... 5  
3.01 WORK INVOLVING OTHER TRADES ..... 5  
3.02 ACCEPTANCE PROCEDURE ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.

**1.02 SUMMARY**

- A. This Section includes mechanical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 01 Specification Sections.

**1.03 INDUSTRY STANDARDS**

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
  1. AABC – Associated Air Balance Council.
  2. ABMA - American Bearing Manufacturers Association.
  3. ABMA – American Boiler Manufacturers Association.
  4. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The).
  5. AMCA - Air Movement and Control Association International, Inc.
  6. ANSI – American National Standards Institute.
  7. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers.
  8. ASTM – American Society for Testing Materials.
  9. CDA – Copper Development Association.
  10. CGA – Compressed Gas Association.
  11. CSA – CSA International.
  12. HI – Hydraulic Institute.
  13. Intertek – Intertek Group.
  14. NAIMA – North American Insulation Manufacturers Association.
  15. NEBB – National Environmental Balancing Bureau.
  16. NEC – National Electrical Code.
  17. NECA - National Electrical Contractors Association.
  18. NEMA – National Electrical Manufacturer’s Association.
  19. NFPA – National Fire Protection Association.
  20. SMACNA – Sheet Metal and Air Conditioning Contractors National Association.
  21. UL – Underwriter’s Laboratories, Inc.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### **1.04 PERFORMANCE REQUIREMENTS**

- A. Systems Components Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

#### **1.05 QUALITY ASSURANCE**

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test and leave ready for operation the mechanical systems as specified and as indicated on Drawings.
  - 1. Contract Documents are complimentary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State and local ordinances and regulations, the Rules and Regulations of ASHRAE, NFPA, SMACNA and UL, unless otherwise indicated.
  - 1. Notify the Architect/Engineer in writing before submitting a proposal should any changes in Drawings or Specifications be required to conform to the above codes, rules or regulations.
  - 2. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without notice to A/E, the Contractor shall bear all costs arising from corrective measures.
- C. Source Limitations: Obtain equipment and other components of the same or similar systems through one source from a single manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Perform work to avoid interference with the work of other trades. Remove and relocate work which in the opinion of the Owner's Representatives causes interference.
- G. Labeling Requirement for Packaged Equipment: Electrical panels on packaged mechanical equipment shall bear UL label or label of other Nationally Recognized Testing Laboratory (NRTL) (Intertek, CSA, etc.).

#### **1.06 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals and fees for Mechanical Work shall be secured and paid for by the Contractor. All Work shall conform to all applicable codes, rules and regulations.
- B. Rules of local utility companies shall be complied with. Check with each utility company supplying service to the installation and determine all devices including, but not limited to, all valves, meter boxes, and meters which will be required and include the cost of all such items in proposal.
- C. All work shall be executed in accordance with the rules and regulations set forth in local and state codes. Prepare any detailed drawings or diagrams which may be required by the governing authorities. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications shall govern.
- D. Refer to Division 22 Section "Domestic Water Piping" for purchase and installation of potable water meters.

#### **1.07 DRAWINGS**

- A. The drawings show the location and general arrangement of equipment, piping and related items. They shall be followed as closely as elements of the construction will permit.

- B. Examine the drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly. Provide fittings, valves, and accessories as required to meet actual conditions.
- C. Deviations from the drawings, with the exception of minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The Architectural and Structural Drawings take precedence in all matters pertaining to the building structure, Mechanical Drawings in all matters pertaining to Mechanical Trades and Electrical Drawings in all matters pertaining to Electrical Trades. Where there are conflicts or differences between the drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

#### **1.08 MATERIAL AND EQUIPMENT MANUFACTURERS**

- A. Equipment: All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new and shall be standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment and shall be the manufacturer's latest design.
- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, piping, sheet metal, electrical work, and building alterations shall be included in the original Bid.
- C. All package unit equipment and skid mounted mechanical components that are factory assembled shall meet, in detail, the products named and specified within each section of the Mechanical and Electrical Specifications.
- D. Changes Involving Electrical Work: The design of the mechanical systems is based on the equipment scheduled on the Drawings. 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 with no additional cost to project. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
  - 1. Where equipment changes are made that involve additional Electrical Work (larger size motor, additional wiring of equipment, etc.) the Mechanical Trades involved shall compensate the Electrical Trades for the cost of the additional Work required.

#### **1.09 INSPECTION OF SITE**

- A. Visit the site, examine and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.
- B. No contract sum adjustments or contract time extensions will be made for Contractor claims arising from conditions which were or could have been observable, ascertainable or reasonably foreseeable from a site visit or inquiry into local conditions affecting the execution of the work.

#### **1.10 ITEMS REQUIRING PRIOR APPROVAL**

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 01 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.
  - 1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.

2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, piping, sheet metal, electrical, replacement of other components, and building alterations shall be included in the original bid.
- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid, but will not affect the awarding of the contract.

### 1.11 SUBMITTALS

- A. Submit project specific submittals for review in compliance with Division 01.
- B. Prepare shop drawings to scale for the Architect/Engineer for review. Equipment and material submittals required are indicated in the Mechanical; Fire Suppression; Plumbing; and Heating, Ventilating and Air Conditioning Sections. Refer to Division 01 for submittal quantities.
- C. All submittals shall be submitted in groupings of similar and/or related items. Plumbing fixture submittals shall be submitted as one package including all fixtures intended to be used for this project. Incomplete submittal groupings will be returned "Rejected". Submit shop drawing with identification mark number or symbol numbers as specified or scheduled on the Mechanical Drawings.
- D. All submittals shall be project specific. Standard detail drawings and schedule not clearly indicating which data is associated with this Project will be returned "Rejected".
- E. Shop drawings shall be reviewed by the Mechanical Contractor for completeness and accuracy prior to submitting to the Architect/Engineer for review. The shop drawings shall be dated and signed by the Mechanical Contractor prior to submission.
- F. No equipment shall be shipped from stock or fabricated until shop drawings for them have been reviewed by the Architect/Engineer. Review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Any action indicated is subject to the requirement of the plans and specifications.
  1. By the review of shop drawings, the Architect/Engineer does not assume responsibility for actual dimensions or for the fit of completed work in position, nor does such review relieve Mechanical Trades of full responsibility for the proper and correct execution of the work required.
  2. Contractor is responsible for:
    - a. Dimensions, which shall be confirmed and correlated at the job site.
    - b. Fabrication processes and techniques of construction.
    - c. Quantities.
    - d. Coordination of Contractor's work with all other trades.
    - e. Satisfactory performance of Contractor's work.
    - f. Temporary aspects of the construction process.
- G. If deviations (not substitutions) from Contract Documents are deemed necessary by the Contractor, details of such deviations, including changes in related portions of the project and the reasons therefore, shall be submitted with the submittal for approval.

### 1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all mechanical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. One copy of all manuals shall be furnished for Owner. Maintenance and operating instructional manuals shall be provided when construction is approximately 75 percent complete.
- C. Format: Submit operations and maintenance manuals in the following format:
  1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
- D. The operating and maintenance instructions shall include a brief, general description for all mechanical systems including, but not limited to:
  1. Routine maintenance procedures.
  2. Lubrication chart listing all types of lubricants to be used for each piece of equipment and the recommended frequency of lubrication.

3. Trouble-shooting procedures.
4. Contractor's telephone numbers for warranty repair service.
5. Submittals.
6. Recommended spare parts list.
7. Names and telephone numbers of major material suppliers and subcontractors.
8. System schematic drawings.

#### **1.13 RECORD DRAWINGS**

- A. Submit record drawings in compliance with Division 01.
- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media or vellum which have been neatly marked to represent as-built conditions for all new mechanical work.
- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer and Owner at their request.

#### **1.14 INSTRUCTION OF OWNER PERSONNEL**

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of mechanical equipment and systems at agreed upon times. A minimum of 24 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. In addition to individual equipment training provide overview of each mechanical system. Utilize the as-built documents for this overview.
- E. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

#### **1.15 WARRANTY**

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the mechanical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this mechanical installation which becomes defective within a period of one year (unless specified otherwise in other Mechanical; Fire Suppression; Plumbing; or Heating, Ventilating and Air Conditioning Sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship or failure to follow the contract documents.
- B. File with the Owner any and all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

### **PART 2 PRODUCTS (NOT APPLICABLE)**

### **PART 3 EXECUTION**

#### **3.01 WORK INVOLVING OTHER TRADES**

- A. Certain items of equipment or materials specified in the Mechanical Division may have to be installed by other trades due to code requirements or union jurisdictional requirements. In such instances, the Contractor shall complete the work through an approved, qualified subcontractor and shall include the full cost for same in proposal.

#### **3.02 ACCEPTANCE PROCEDURE**

- A. Upon successful completion of start-up and recalibration, but prior to building acceptance, substantial completion and commencement of warranties, the Architect/Engineer shall be requested in writing to observe the satisfactory operation of all mechanical control systems.
- B. The Contractor shall demonstrate operation of equipment and control systems, including each individual component, to the Owner and Architect/Engineer.
- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect/Engineer for observation and approval.

- D. After all items on the punch list are corrected and formal approval of the mechanical systems is provided by the Architect/Engineer, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.
- E. Operation of the following systems shall be demonstrated:
  - 1. Air Handling Systems.
  - 2. Refrigeration Systems.
  - 3. Domestic Hot Water Heaters.
  - 4. Domestic Hot Water Mixing Stations.
  - 5. Temperature Controls.
  - 6. Building Automation System.
  - 7. Exhaust Systems.
  - 8. Electric Baseboard Heaters.
  - 9. Electric Cabinet Unit Heaters.
  - 10. Sump Pump.
- F. For systems requiring seasonal operation, demonstrate system performance within six months when weather conditions are suitable.

**END OF SECTION**

**SECTION 20 05 10 - BASIC MECHANICAL MATERIALS AND METHODS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUMMARY ..... 1  
1.3 DEFINITIONS ..... 2  
1.4 SUBMITTALS ..... 2  
1.5 QUALITY ASSURANCE ..... 2  
1.6 DELIVERY, STORAGE, AND HANDLING ..... 3  
1.7 COORDINATION ..... 3  
PART 2 - PRODUCTS ..... 3  
2.1 MANUFACTURERS ..... 3  
2.2 PIPE, TUBE, AND FITTINGS ..... 3  
2.3 JOINING MATERIALS ..... 3  
2.4 PIPE THREAD COMPOUNDS ..... 4  
2.5 TRANSITION FITTINGS ..... 4  
2.6 DIELECTRIC FITTINGS ..... 5  
2.7 MODULAR MECHANICAL SEALS ..... 6  
2.8 SLEEVES ..... 6  
2.9 ESCUTCHEONS ..... 6  
2.10 GROUT ..... 6  
2.11 EPOXY BONDING COMPOUND ..... 6  
2.12 LEAK DETECTOR SOLUTION ..... 7  
2.13 PIPE ROOF PENETRATION ENCLOSURES ..... 7  
PART 3 - EXECUTION ..... 7  
3.1 PIPING SYSTEMS - COMMON REQUIREMENTS ..... 7  
3.2 PIPING JOINT CONSTRUCTION ..... 9  
3.3 ACCESS DOORS ..... 11  
3.4 EQUIPMENT CONNECTIONS ..... 11  
3.5 PIPING CONNECTIONS ..... 11  
3.6 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS ..... 11  
3.7 PAINTING ..... 11  
3.8 CONCRETE BASES ..... 12  
3.9 ERECTION OF METAL SUPPORTS AND ANCHORAGES ..... 12  
3.10 EPOXY BONDING TO EXISTING MATERIALS ..... 12  
3.11 JACKING OF PIPE ..... 12  
3.12 ERECTION OF WOOD SUPPORTS AND ANCHORAGES ..... 12  
3.13 GROUTING ..... 12  
3.14 CUTTING, CORING AND PATCHING ..... 13  
3.15 EXCAVATION AND BACKFILLING ..... 13  
3.16 FLASHING ..... 13  
3.17 LUBRICATION ..... 13  
3.18 FILTERS ..... 13  
3.19 CLEANING ..... 13

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 22 Section "Domestic Water Piping" for flushing and cleaning of potable water piping.

**1.02 SUMMARY**

- A. This section includes mechanical materials and installation methods common to mechanical piping systems, sheet metal systems and equipment. This section supplements all other Division 20, 21, 22, and 23 Mechanical Sections, and Division 01 Specification Sections.

### 1.03 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. CPVC: Chlorinated polyvinyl chloride plastic.
  - 3. PE: Polyethylene plastic.
  - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

### 1.04 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Escutcheons.
- B. Welding certificates.
- C. Brazing Certificates: As required by ASME Boiler and Pressure Vessel Code, Section IX, or AWS B2.2.

### 1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- B. Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.
- D. Comply with NSF 372, "Drinking Water System Components – Lead Content" for potable domestic water piping and components.
- E. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- F. 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.
- G. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- H. Soldering: Qualify processes and operators according to AWS B2.3/2.3M, "Specification for Soldering Procedure and Performance Qualification."
- I. Installer Qualifications:



1. Installers of Grooved Components: Installers shall be certified by the grooved component manufacturer as having been trained and qualified to join piping with grooved couplings, fittings, and specialties.
2. Installers of Pressure-Sealed Joints: Installers shall be certified by the pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Storage and Protection: Provide adequate weather protected storage space for all mechanical equipment and materials deliveries to the job site. Storage locations will be designated by the Owner's Representative. Equipment stored in unprotected areas must be provided with temporary protection.
  1. Protect equipment and materials from theft, injury or damage.
  2. Protect equipment outlets, pipe and duct openings with temporary plugs or caps.
  3. Materials with enamel or glaze surface shall be protected from damage by covering and/or coating as recommended in bulletin "Handling and Care of Enameled Cast Iron Plumbing Fixtures", issued by the Plumbing Fixtures Manufacturer Association, and as approved.
  4. Electrical equipment furnished by Mechanical Trades and installed by the Electrical Trades: Turn over to Electrical Trades in good condition, receive written confirmation of same.
  5. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
  6. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### **1.07 COORDINATION**

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations. Coordinate with other trades to ensure accurate locations and sizes of mechanical spaces, chases, slots, shafts, recesses and openings.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Install Work to avoid interference with work of other trades including, but not limited to, Architectural and Electrical Trades. Remove and relocate any work that causes an interference at Contractor's expense.
- D. Coordinate requirements for and provide access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."
- E. The mechanical trades shall be responsible for all damage to other work caused by their work or through the neglect of their workers.
  1. All patching and repair of any such damaged work shall be performed by the trades which installed the work. The cost shall be paid by the Mechanical Trades.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### **2.02 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 21, 22, and 23 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.

#### **2.03 JOINING MATERIALS**

- A. Refer to individual Division 21, 22, and 23 piping Sections for special joining materials not listed below.
- B. Unions: Pipe Size 2 Inches and Smaller:
  1. Ferrous pipe: Malleable iron ground joint type unions.
  2. Unions in galvanized piping system shall be galvanized.
  3. Copper tube and pipe: Bronze unions with soldered joints.
- C. Flanges: Pipe Sizes 2-1/2 Inch and Larger:
  1. Ferrous pipe: Standard weight, forged steel weld neck flanges.

2. Copper tube and pipe: Slip-on bronze flanges.
- D. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- E. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated. Square head bolts and nuts are not acceptable.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- G. Solder Filler Metals: ASTM B 32, lead-free, antimony-free, silver-bearing alloys. Include water-flushable flux according to ASTM B 813.
- H. Brazing Filler Metals: Alloys meeting AWS A5.8.
  1. Use Type BcuP Series, silver-bearing, copper-phosphorus alloys for joining copper or bronze socket fittings with copper pipe. Flux is prohibited unless used with bronze fittings.
  2. Use Type Bag Series, cadmium-free silver alloys for joining copper with steel, stainless steel, or other ferrous alloys.
- I. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- J. Welding Materials: Comply with Section II, Part C, of ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.
- K. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.
- L. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- M. Solvent Cements for Joining ABS Piping: ASTM D 2235.
- N. Solvent Cements for Joining PVC to ABS Piping Transition: ASTM D 3138.
- O. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

#### **2.04 PIPE THREAD COMPOUNDS**

- A. Pipe thread compounds for the fluid service compatible with piping materials provided.
- B. Compounds for potable water service and similar applications acceptable to U.S. Department of Agriculture (USDA) or Food and Drug Administration (FDA). Compounds containing lead are prohibited.
- C. Inorganic zinc-rich coatings or corrosion inhibited proprietary compounds for galvanized carbon steel systems to coat raw carbon steel surfaces, in lieu of subsequent painting.
  1. Manufacturers:
    - a. Carboline "Carbo-Zinc 12."
    - b. Tnemec.
    - c. Koppers.
- D. Graphite and oil or proprietary corrosion inhibited compounds suitable for system temperatures for steam or condensate.
  1. Manufacturers:
    - a. WKM; Division of Cooper Industries, Inc., Key "Graphite Paste."
    - b. Other approved.
- E. Use tetrafluoroethylene (Teflon) tape 2 to 3 mils thick for natural gas system threaded joints.
  1. Manufacturers:
    - a. Cadillac Plastic.
    - b. Permacel.
    - c. Other approved.

#### **2.05 TRANSITION FITTINGS**

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.

- b. Dresser Industries, Inc.; DMD Div.
- c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
- d. JCM Industries.
- e. Smith-Blair, Inc.
- f. Viking Johnson.
2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  1. Manufacturers:
    - a. IPEX Inc. (formerly Eslon Thermoplastics).
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  1. Manufacturers:
    - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  1. Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Non-pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
  1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.
    - e. Can-Tex Industries Division of Harsco Corp. "CT-Adaptors".
    - f. Joint Inc., "Caulder".

## 2.06 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. Brass Unions, Brass Nipples, Brass Couplings: For systems up to 286 deg F.
- D. Dielectric-Flange Kits: Include full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Capitol Manufacturing Co.
    - d. Central Plastics Company.
    - e. Epco Sales, Inc.
    - f. Pipeline Seal and Insulator, Inc.
    - g. Watts Water Technologies, Inc.; Watts Regulator Co.
    - h. Zurn Industries, Inc.; Wilkins Div.
  2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; female NPT threaded ends; and 300-psig minimum working pressure at 225 deg F.
  1. Manufacturers:
    - a. Lochinvar Corp.; V-Line Insulating Couplings.
- F. Dielectric Nipple/Waterway Fittings: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, male NPT threaded, or grooved ends; and 300-psig minimum working pressure at 230 deg F.
  1. Manufacturers:

- a. Anvil International, Inc.; Gruvlok Manufacturing; DI-LOK Nipples.
- b. Elster Group; Perfection Corp.; ClearFlow.
- c. Precision Plumbing Products, Inc.; ClearFlow.
- d. Sioux Chief Manufacturing Co., Inc.
- e. Tyco Fire & Building Products; Grinnell Mechanical Products; Figure 407 ClearFlow.
- f. Victaulic Co. of America; Style 47 ClearFlow.

## 2.07 MODULAR MECHANICAL SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve or pipe and core drilled hole.
  1. Manufacturers:
    - a. Advance Products & Systems, Inc.; Innerlynx.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.; Thunderline Link Seal.
  2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  3. Pressure Plates: Carbon steel. Include two for each sealing element.
  4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.08 SLEEVES

- A. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall black.
- B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, and 0.375 inch wall galvanized, plain ends.
- C. Water Stop: Cast or ductile-iron; fabricated steel; PVC; or rotationally molded HDPE pipe; with plain ends and integral water stop, unless otherwise indicated.
  1. Manufacturers:
    - a. Advance Products & Systems, Inc.; Infinity and Gal-Vo-Plast Sleeves.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
- 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.

## 2.09 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
  1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping or Piping in High Humidity Areas: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping in Finished Spaces: One-piece, stamped-steel type.
    - e. Bare Piping in Unfinished Service Spaces or Equipment Rooms: Split-plate, stamped-steel type with concealed hinge and set screw.

## 2.10 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.

## 2.11 EPOXY BONDING COMPOUND

- A. Two-component system suitable for bonding wet or dry concrete to each other and to other materials.
- B. Manufacturers:
  1. Euco 452 #450; Euclid Chemical Co.
  2. Epobond; L & M Construction Chemicals.

3. Sikadur 87; Sika Corp.

## **2.12 LEAK DETECTOR SOLUTION**

- A. Commercial leak detector solution for pipe system testing.
- B. Manufacturers:
  1. American Gas and Chemicals Inc.; Leak Tec.
  2. Cole-Parmer Inst. Co.; Leak Detector.
  3. Guy Speaker Co. Inc.; Squirt 'n Bubbles.

## **2.13 PIPE ROOF PENETRATION ENCLOSURES**

- A. Manufacturers:
  1. Pate Company (The).
  2. Portals Plus, Inc.
  3. Thybar Corporation; Thycurb.
- B. Minimum 18 gage welded galvanized steel construction.
- C. Integral base plate.
- D. Built-in fully mitered cant.
- E. Factory installed insect and decay resistant wood nailer.
- F. Factory installed 1-1/2 inch thick, 3 pounds per cubic foot density rigid insulation.
- G. EPDM compression molded rubber cap for single or multiple pipes as required.
- H. Stainless steel draw-band clamps.

## **PART 3 EXECUTION**

### **3.01 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Refer to piping application schedules on the Drawings.
- B. Install piping according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems, and in accordance with manufacturer's instructions.
- C. 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. The Drawings shall be followed as closely as elements of construction will permit.
- D. During the progress of construction, protect open ends of pipe, fittings, and valves to prevent the admission of foreign matter. Place plugs or flanges in the ends of all installed work whenever work stops. Plugs shall be commercially manufactured products.
- E. Prior to and during laying of pipe, maintain excavations dry and clear of water and extraneous materials. Provide minimum 4 inches of clearance in all directions for pipe passing under or through building grade beams.
- F. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells in steel pipe. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- G. Brazolets can be used for annular flow measuring devices, temperature control components, and thermal wells in copper tube. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- H. Clean and lubricate elastomer joints prior to assembly.
- I. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.
- J. Install piping to conserve building space and not interfere with use of space.
- K. Group piping whenever practical at common elevations.
- L. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- M. Slope piping and arrange systems to drain at low points.
- N. Slope horizontal piping containing non-condensable gases 1 inch per 100 feet, upward in the direction of the flow.
- O. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- P. 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.
- Q. In concealed locations where piping, other than black steel, cast-iron, or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1-1/2 inches from the nearest edge of the member, the pipe shall be protected by shield plates. Protective shield plates shall be a minimum of 1/16 inch thick steel, shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 2 inches above sole plates and below top plates.
- R. Do not penetrate building structural members unless specifically indicated on drawings.
- S. Install piping above accessible ceilings to allow sufficient space for ceiling panel and light fixture removal.
- T. Install valves with stems upright or horizontal, not inverted.
- U. Provide clearance for installation of insulation and access to valves and fittings.
- V. Install piping to permit valve and equipment servicing. Do not install piping below valves and/or terminal equipment. Do not install piping above electrical equipment.
- W. Install piping at indicated slopes. Provide drain valves with hose end connections and caps at all piping low points, where piping is trapped and at all equipment.
- X. Install piping free of sags and bends.
- Y. Install fittings for changes in direction and branch connections.
- Z. Unless otherwise indicated or specified, install branch connections to mains using tee fittings in main pipe:
  - 1. Branch connected to bottom of main pipe for HVAC systems. Side connection is acceptable. Connection above centerline of main is unacceptable. For up-feed risers, connect branch to top of main pipe.
  - 2. Branch connected to top of main for steam and condensate, plumbing systems, compressible gasses, and vacuum.
- AA. Install piping to allow application of insulation.
- BB. Select system components with pressure rating equal to or greater than system operating pressure.
- CC. After completion, fill, clean, and treat systems. Refer to Division 23 Sections "Hydronic Piping," "Piping Systems Flushing and Chemical Cleaning," and "HVAC Water Treatment."
- DD. Install escutcheons for penetrations of walls below ceiling, and ceilings.
- EE. Sleeves are not required for core-drilled holes in poured concrete walls.
- FF. Permanent sleeves are not required for holes formed by removable PE sleeves in poured concrete walls.
- GG. Install sleeves for pipes passing through footings and foundation walls, masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces of walls.
    - a. Exception: Extend sleeves installed in floors 2 inches above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Schedule 40 Black Steel Sleeves: For pipes smaller than NPS 12 penetrating interior walls.
    - b. 0.375 Inch Wall Black Steel Sleeves: For pipes NPS 12 and larger penetrating interior walls.
    - c. Schedule 40 Galvanized Steel Sleeves: For pipes smaller than NPS 12 penetrating floors, and roof slabs.
    - d. 0.375 Inch Wall Galvanized Steel Sleeves: For pipes NPS 12 and larger penetrating floors and roof slabs.
    - e. For pipes penetrating floors with membrane water proofing provide cast iron sleeve with clamping flanges. Secure/seal membrane to sleeves with clamping flanges.
  - 4. Seal sleeves in concrete floors roof slabs and masonry walls with grout.
  - 5. Seal sleeves in plaster/gypsum board partitions with plaster or dry wall compound and caulk with non-hardening silicone sealant to provide airtight installation.
  - 6. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- HH. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.

1. Install Schedule 40 galvanized steel pipe for sleeves smaller than 12 inches in diameter.
  2. Install 0.375 galvanized steel pipe for sleeves 12 inches and larger in diameter.
  3. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical 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.
- II. New, Poured Concrete, Underground, Exterior-Wall and Slab on Grade Pipe Penetrations: Install water stop sleeves prior to pour. Seal pipe penetrations using modular mechanical seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing modular mechanical seals.
1. Modular Mechanical Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble modular mechanical 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.
- JJ. 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 Specification Sections for materials.
- KK. Seal openings around pipes in sleeves and around duct openings through walls, floors and ceilings, and where floors, fire rated walls and smoke barriers are penetrated. Fire and/or smoke barriers shall be UL listed firestopping and shall have a fire rating equal to or greater than the penetrated barrier. Refer to Division 07 Specification Sections for materials.
- LL. Pipe Roof Penetration Enclosures:
1. Coordinate delivery of roof penetration enclosures to jobsite.
  2. Locate and set curbs on roof.
  3. Framing, flashing, and attachment to roof structure are specified under Division 07.
  4. Attach cap to curbs, cut pipe boots to fit pipe, and clamp boots to pipe or conduit.
- MM. Verify final equipment locations for roughing-in.
- NN. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.02 PIPING JOINT CONSTRUCTION**

- A. Join pipe and fittings according to the following requirements and Division 21, 22, and 23 Sections specifying piping systems.
- B. Cut piping square.
- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, oil, and debris from inside and outside of pipe and fittings before assembly.
- E. Clean damaged galvanized surfaces and touch-up with a zinc rich coating.
- F. Use standard long sweep pipe fittings for changes in direction. No mitered joints or field fabricated pipe bends will be permitted. Short radius elbows may be used where specified or specifically authorized by the Architect.
- G. Make tee connections with screwed tee fittings, soldered fittings or specified welded connections. Make welded branch connections with either welding tees or forged branch outlet fittings in accordance with ASTM A234, ANSI B16.9 and ANSI B16.11. For forged branch outlets, furnish forged fittings flared for improved flow where attached to the run, reinforced against external strains and to full pipe-bursting strength requirements. "Fish-mouth" connections are not acceptable.
- H. Use eccentric reducers for drainage and venting of pipe lines; bushings are not permitted.
- I. Provide pipe openings using fittings for all systems control devices, thermometers, gauges, etc. Drilling and tapping of pipe wall for connections is prohibited.
- J. Provide temperature sensing device thermal wells and similar piping specialty connections.
- K. Provide instrument connections except thermal wells with specified isolating valves at point of connection to system.
- L. Locate instrument connections in accordance with manufacturer's instructions for accurate read-out of function sensed. Locate instrument connections for easy reading and service of devices.
- M. 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."
- N. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

- O. 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.
- P. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
  - 1. Weld-o-lets and thread-o-lets can be used for annular flow measuring devices, temperature control components, and thermal wells. Pipe taps shall be drilled and deburred. Torch cutting is not acceptable.
- Q. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on gaskets and bolt threads.
  - 1. Assemble flanged joints with fresh-stock gasket and hex head nuts, bolts or studs. Make clearance between flange faces such that the connections can be gasketed and bolted tight without strain on the piping system. Align flange faces parallel and bores concentric; center gaskets on the flange faces without projection into the bore.
  - 2. Lubricate bolts before assembly to insure uniform bolt stressing. Draw up and tighten bolts in staggered sequence to prevent unequal gasket compression and deformation of the flanges. Do not mate a flange with a raised face to a companion flange with a flat face; machine the raised face down to a smooth matching surface and use a full face gasket. After the piping system has been tested and is in service at its maximum temperature, check bolting torque to provide required gasket stress.
- R. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Galvanized piping shall be cut grooved to prevent damage to galvanizing on internal pipe surfaces. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved joint products. The manufacturer's representative shall periodically visit the jobsite and review installation. Contractor shall remove and replace any joints deemed improperly installed.
- S. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.
- T. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.
- U. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials. Refer to Application Schedules on the Drawings.
- V. 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.
- W. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- X. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.
- Y. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- Z. Remake joints which fail pressure tests with new materials including pipe, fittings, gaskets and/or a filler.



### 3.03 ACCESS DOORS

- A. Provide access doors for installation by architectural trades unless noted otherwise. Provide access doors in the walls, as required to make all valves, controls, coils, motors, air vents, filters, electrical boxes and other equipment installed by the Contractor accessible. Minimum size 12 inches x 12 inches. Provide access doors in the ceiling, for accessibility as mentioned above, 24 inches x 24 inches minimum size. Areas with accessible ceilings (ceilings where lay-in panels are not fastened in place and can be individually removed without removal of adjacent tiles) will not require access doors. Refer to Division 08 Section "Access Doors and Frames" for manufacturers and model numbers and additional information.
- B. When access doors are in fire resistant walls or ceilings, they shall bear the Underwriters' Laboratories, Inc., Label, with time design rating equal to or greater than the wall or ceiling unless they were a part of the tested assembly.

### 3.04 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, fixtures, and other items included in the work in accordance with the submittals and rough-in measurements furnished by the manufacturers of the particular equipment furnished.
  - 1. Any and all additional connections not shown on the drawings but shown on the equipment manufacturer's submittal or required for the successful operation of the equipment shall be installed as part of this Contract at no additional charge to the Owner.
- B. All piping connections to pumps, coils, and other equipment shall be installed without strain at the pipe connection of this equipment. When directed, remove the bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected.

### 3.05 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, where indicated on Drawings, at final connection to each piece of equipment and at all control valves.

### 3.06 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated. Housekeeping pad locations and sizes shall be coordinated by mechanical contractor prior to the placement of concrete slabs.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. For suspended equipment, furnish and install all inserts, rods, structural steel frames, brackets and platforms required. Obtain approval of Architect for same including loads, locations and methods of attachment.
- F. Equipment Rigging Over Roof Areas: Protect building structure against damage during equipment rigging. Make provisions to distribute load of equipment to main roof structure, and to prevent damage to roof decking, roofing, or purlins.
- G. The Contract Documents indicate items to be purchased and installed. The items are noted by a manufacturer's name, catalog number and/or brief description. The catalog number may not designate all the accessory parts for a particular application. Arrange with the manufacturer for the purchase of all items required for a complete installation.

### 3.07 PAINTING

- A. Painting of mechanical systems, equipment, and components is specified in Division 09.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### **3.08 CONCRETE BASES**

- A. Concrete housekeeping pads for floor mounted mechanical equipment shall be provided by Architectural Trades.
- B. 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 as shown on Drawings or specified, 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.

### **3.09 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 mechanical materials and equipment.
- C. Where pipe and/or equipment support members must be welded to structural building framing, Contractor shall seek prior approval from Architect and structural engineer. Scrape, brush clean, and apply one coat of zinc rich primer after welding.
- D. Field Welding: Comply with AWS D1.1.

### **3.10 EPOXY BONDING TO EXISTING MATERIALS**

- A. Use epoxy bonding compound to set sleeves or pipes in existing concrete to bond new concrete and/or grout to existing materials or to bond dissimilar materials.
- B. The compound, when applied in accordance with the manufacturer's instructions, shall be capable of initial curing within 48 hours at temperatures as low as 40 deg F and shall be capable of bonding any combination of the following properly prepared materials: Wet or dry, cured or uncured concrete or mortar; vitrified clay; cast iron and carbon steel.

### **3.11 JACKING OF PIPE**

- A. Do not jack pipe in place except upon prior approval of proposed materials and complete details of methods.

### **3.12 ERECTION OF WOOD SUPPORTS AND ANCHORAGES**

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### **3.13 GROUTING**

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.

- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

#### **3.14 CUTTING, CORING AND PATCHING**

- A. Refer to Division 01 Specification Sections for requirements for cutting, coring, patching and refinishing work necessary for the installation of mechanical work.
- B. All cutting, coring, patching and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

#### **3.15 EXCAVATION AND BACKFILLING**

- A. Refer to Division 31 Specification Sections.
- B. Provide all excavation, trenching, tunneling and backfilling required for the mechanical work.
- C. Provide all pumping and/or well pointing required for the mechanical work.
- D. Provide foundations if required to support underground piping.
- E. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.

#### **3.16 FLASHING**

- A. Provide all flashing required for mechanical work. Refer to Division 07 Specification Sections.

#### **3.17 LUBRICATION**

- A. Provide all lubrication for the operation of the equipment until acceptance by the Owner. Contractor is responsible for all damage to bearings up to the date of acceptance of the equipment. Protect all bearings and shafts during installation. Thoroughly grease steel shafts to prevent corrosion. Provide covers as required for proper protection of all motors and other equipment during construction.

#### **3.18 FILTERS**

- A. Provide and maintain filters in air handling systems throughout the construction period and prior to final acceptance of the building. Do not run air handling equipment, without all prefilters and final filters as specified.
- B. Immediately prior to final building acceptance by the Owner, Contractor shall:
  - 1. Thoroughly wash, recharge and reinstall cleanable type air filters.
  - 2. Replace all disposable type air filters with new units.

#### **3.19 CLEANING**

- A. Each Mechanical Trade shall be responsible for removing all debris daily as required to maintain the work area in a neat, orderly condition.
- B. After equipment and HVAC water piping systems have been completed and tested, each entire system shall be cleaned and flushed. Refer to Division 23 Section "Piping Systems Flushing and Chemical Cleaning" for requirements. Provide temporary bypass piping and fittings, temporary valves and strainers, temporary water make-up piping with approved means of backflow prevention, and temporary pumps as needed to perform specified flushing and cleaning requirements.
- C. Flushing, cleaning, and disinfection of domestic water piping is specified in Division 22 Section "Domestic Water Piping."
- D. Exterior surfaces of all piping, ductwork and equipment shall be wiped down to remove excess dirt and debris prior to concealment by Architectural Trades work.
- E. Upon completion of work in each respective area, clean and protect work. Just prior to final acceptance, perform additional cleaning as necessary to provide clean equipment and areas to the Owner.

**END OF SECTION**

This page intentionally left blank

**SECTION 20 05 13 - MOTORS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUMMARY ..... 1  
1.3 DEFINITIONS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
1.5 COORDINATION ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 MANUFACTURERS ..... 2  
2.2 MOTOR REQUIREMENTS ..... 2  
2.3 MOTOR CHARACTERISTICS ..... 2  
2.4 POLYPHASE MOTORS ..... 3  
2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS ..... 5  
2.6 SINGLE-PHASE MOTORS ..... 5  
2.7 ENCLOSED CONTROLLERS ..... 5  
2.8 ENCLOSED SWITCHES AND CIRCUIT BREAKERS ..... 6  
2.9 FUSES ..... 6  
PART 3 - EXECUTION ..... 6  
3.1 FIELD QUALITY CONTROL ..... 6  
3.2 ADJUSTING ..... 6  
3.3 CLEANING ..... 6

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 "Mechanical General Requirements."
  - 2. Division 20 Section "Mechanical Vibration Controls" for mounting motors and vibration isolation devices.
  - 3. Division 21, 22, and 23 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.
  - 4. Division 26 Section "Enclosed Switches and Circuit Breakers".
  - 5. Division 26 Section "Enclosed Controllers".
  - 6. Division 26 Section "Fuses".

**1.02 SUMMARY**

- A. This Section includes basic requirements for factory-installed and field-installed motors, enclosed controllers, disconnect switches, and fuses.

**1.03 DEFINITIONS**

- A. ABMA: American Bearing Manufacturers Association. (Formerly AFBMA: Anti-Friction Bearing Manufacturers Association.)
- B. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.
- C. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.
- D. Packaged Self Contained Equipment: Equipment which includes component mechanical and electrical equipment mounted on common bases, skids or frames or in common enclosures with internal control and power wiring factory installed and ready to accept a single electrical service connection. Provide the equipment complete with enclosed controllers, main disconnect switches, control transformers, control devices, wiring and accessories as required.

**1.04 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL), acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NFPA 70.

### 1.05 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:
1. Compatible with the following:
    - a. Magnetic controllers.
    - b. Multispeed controllers.
    - c. Reduced-voltage controllers.
    - d. Solid-state controllers.
    - e. Variable frequency controllers.
  2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
  3. Matched to torque and horsepower requirements of the load.
  4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate electrical scope of work to be provided by Division 20, 21, 22, and 23 with this Section, related Division 20, 21, 22, and 23 Specifications, Division 26 Specifications and the Drawings.
- C. Electrical work provided under Division 20, 21, 22, and 23: Furnish UL Listed components in accordance with this section, Division 26, and applicable NEMA and NEC (ANSI C 1) requirements. Provide wiring, external to electrical enclosures, in conduit.
- D. Furnished, installed and wired under Division 20, 21, 22, and 23 unless otherwise indicated:
1. Disconnected components in packaged self-contained equipment that are so constructed that components of wiring must be disconnected for shipment and reconnected after installation.
- E. Furnished and installed under Division 20, 21, 22, and 23 and wired under Division 26 unless otherwise indicated:
1. Motors required for mechanical equipment
  2. Packaged Self-Contained Equipment:
    - a. Provide equipment ready to accept a single electrical service connection.
    - b. For equipment with remote mounted control panels, provide mounting of the control panel and external wiring from the control panel to the package self-contained equipment.
  3. Variable frequency controllers.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
1. Dayton.
  2. Toshiba Intl.
  3. Baldor Electric/Reliance.
  4. Rockwell Automation/Allen-Bradley.
  5. Nidec Motor Corporation; U.S. Electrical Motors.
  6. Regal Beloit/GE Commercial Motors.
  7. Regal Beloit/Leeson.
  8. Regal Beloit/Marathon.
  9. Siemens.

### 2.02 MOTOR REQUIREMENTS

- A. Motor requirements apply to factory-installed motors except as follows:
1. Different ratings, performance, or characteristics for a motor are specified in another Section.
  2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
  3. Submersible motors integral to pumps and excluded from NEMA and EISA standards.
- B. Electrical Power Supply Characteristics: Coordinate electrical system requirements with Division 26.
- C. Electrical Power System Characteristics: As scheduled on the Drawings.
- D. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.

### 2.03 MOTOR CHARACTERISTICS

- A. Motors 1/2 HP and Larger: Three phase, unless otherwise indicated.

- B. Motors smaller than 1/2 HP: Single phase, unless otherwise indicated.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- F. 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.
- G. Brake Horsepower Input: Shall not exceed 90 percent of the rated motor horsepower.
- H. Enclosure: Open drip-proof (ODP) for motors installed indoors and out of the airstream. Totally-enclosed fan-cooled (TEFC) for motors installed outdoors or within the airstream.

**2.04 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Fire pump motors, C-face motors, JP and JM frame motors, and motors over 200 horsepower shall be energy efficient motors. Efficiency of the motor shall be determined based on the NEMA MG1. The minimum efficiencies, nominal efficiencies and shall meet or exceed Table 12-11.

HP	1800 RPM OPEN DRIP-PROOF MOTORS 4 POLE		1800 RPM ENCLOSED MOTORS 4 POLE	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM
	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>
1	82.5	81.5	82.5	81.5
1.5	84	82.5	84	82.5
2	84	82.5	84	82.5
3	86.5	85.5	87.5	86.5
5	87.5	86.5	87.5	86.5
7.5	88.5	87.5	89.5	88.5
10	89.5	88.5	89.5	88.5
15	91	90.2	91	90.2
20	91	90.2	91	90.2
25	91.7	91	92.4	91.7
30	92.4	91.7	92.4	91.7
40	93	92.4	93	92.4
50	93	92.4	93	93
60	93.6	93	93.6	93
75	94.1	93.6	94.1	93.6
100	94.1	93.6	94.5	94.1
125	94.5	94.1	94.5	94.1
150	95	94.5	95	94.5
200	95	94.5	95	94.5

HP	1200 RPM OPEN DRIP-PROOF MOTORS 6 POLE		3600 RPM OPEN DRIP-PROOF MOTORS 2 POLE	
	NOMINAL	MINIMUM	NOMINAL	MINIMUM
	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>	<u>EFF</u>
1	80	78.5	--	--
1.5	84	82.5	82.5	81.5
2	85.5	84	84	82.5
3	86.5	85.5	84	82.5
5	87.5	86.5	85.5	84
7.5	88.5	87.5	85.5	86.5
10	90.2	89.5	88.5	87.5
15	90.2	89.5	89.5	88.5





1. Multispeed motors shall have separate winding for each speed.
- E. Rotor: Squirrel cage, unless otherwise indicated.
- F. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for re-lubrication, rated for minimum ABMA 9, L-10 life of 120,000 hours. Calculate bearing load with NEMA minimum V- belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- G. Temperature Rise: Match insulation rating, unless otherwise indicated.
- H. Insulation: Class F, unless otherwise indicated.
- I. Code Letter Designation:
  1. Motors 10 HP and Larger: NEMA starting Code (KVA Code) F or G.
  2. Motors Smaller Than 10 HP: Manufacturer's standard starting characteristic.
- J. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
  1. Finish: Gray enamel.
- K. Sound Level: Not to exceed NEMA MG-1 12.54.

## **2.05 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS**

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
  2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
- C. Shaft Grounding: Provide a means to protect motor from common mode currents.
  1. Required for:
    - a. Motors used with variable frequency controllers.
    - b. Motors 100 HP and larger.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Electro Static Technology, Inc.; Aegis SGR Conductive Microfiber.
- D. Severe-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with nonhygroscopic material.
  1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- E. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:
  1. Measure winding resistance.
  2. Read no-load current and speed at rated voltage and frequency.
  3. Measure locked rotor current at rated frequency.
  4. Perform high-potential test.

## **2.06 SINGLE-PHASE MOTORS**

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
  1. Permanent-split capacitor.
  2. Split-phase start, capacitor run.
  3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. 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.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, pre-lubricated-sleeve type for other single-phase motors.

## **2.07 ENCLOSED CONTROLLERS**

- A. Provide enclosed controllers in accordance with requirements specified in Division 26 Section "Enclosed Controllers".

## **2.08 ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

- A. Provide enclosed switches and circuit breakers in accordance with requirements specified in Division 26 Section "Enclosed Switches and Circuit Breakers".

## **2.09 FUSES**

- A. Provide fuses in accordance with requirements specified in Division 26 Section "Fuses".

## **PART 3 EXECUTION**

### **3.01 FIELD QUALITY CONTROL**

- A. All three phase motors 1/2 HP and above shall be tested by the Testing Agency.
- B. Prepare for acceptance tests as follows:
  - 1. Check motor nameplates for horsepower, speed, phase and voltage.
  - 2. Check coupling alignment and shaft end play.
  - 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
  - 4. Test interlocks and control features for proper operation.
  - 5. Verify that current in each phase is within nameplate rating.
- C. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

### **3.02 ADJUSTING**

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

### **3.03 CLEANING**

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

**END OF SECTION**

**SECTION 20 05 19 - METERS AND GAGES**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
PART 2 - PRODUCTS ..... 1  
2.1 MANUFACTURERS ..... 1  
2.2 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS ..... 1  
2.3 THERMOWELLS ..... 2  
2.4 PRESSURE GAGES ..... 2  
2.5 TEST PLUGS ..... 2  
PART 3 - EXECUTION ..... 3  
3.1 THERMOMETER APPLICATIONS ..... 3  
3.2 GAGE APPLICATIONS ..... 3  
3.3 INSTALLATIONS ..... 3  
3.4 CONNECTIONS ..... 4  
3.5 ADJUSTING ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 DEFINITIONS**

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. FPR: Fiberglass reinforced plastic.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated; include performance curves.
- B. Shop Drawings: Schedule for thermometers, gages and flowmeters indicating manufacturer's number, scale range, and location for each.
- C. Product Certificates: For each type of thermometers, gages and flowmeters, signed by product manufacturer.
- D. Operation and Maintenance Data: For flowmeters to include in operation and maintenance manuals.

**1.04 QUALITY ASSURANCE**

- A. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.

**PART 2 PRODUCTS**

**2.01 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.

**2.02 METAL-CASE, LIQUID-IN-GLASS THERMOMETERS**

- A. Manufacturers:
  - 1. AMETEK, Inc.; U.S. Gauge Div.

2. Miljoco Corporation.
  3. REOTEMP Instrument Corporation.
  4. Trerice, H. O. Co.
  5. Weiss Instruments, Inc.
  6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Case: Die-cast aluminum or Chrome-plated brass, 9 inches long.
- C. Tube: Red, blue, or green reading, organic-liquid filled, with magnifying lens.
- D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.
- E. Window: Glass or plastic.
- F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
- G. Stem: Copper-plated steel, aluminum, or brass for thermowell installation and of length to suit installation.
- H. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

### 2.03 THERMOWELLS

- A. Manufacturers: Same as manufacturer of thermometer being used.
- B. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer. Brass for compatible services less than 353 degrees F; ANSI 18-8 stainless steel for all others to suit service. Furnish extension neck to accommodate insulation where applicable.

### 2.04 PRESSURE GAGES

- A. Manufacturers:
1. AMETEK, Inc.; U.S. Gauge Div.
  2. Cambridge.
  3. Dwyer Instruments, Inc.
  4. Marsh Bellofram.
  5. Miljoco Corporation.
  6. Trerice, H. O. Co.
  7. Weiss Instruments, Inc.
  8. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
1. Case: Stainless steel, aluminum, or FRP, 4-1/2-inch diameter.
  2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
  3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
  4. Movement: Mechanical, with link to pressure element and connection to pointer.
  5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
  6. Pointer: Red or other dark-color metal.
  7. Window: Glass or plastic.
  8. Ring: Stainless steel or chrome plated metal.
  9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
  10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
  11. Water: 0-100 PSIG (1 psi divisions to 50 psi; 5 psi divisions above 50 psi), liquid filled.
  12. Steam (15 psig and less): 30 inches Hg vacuum-30 PSIG (1 inch divisions below 0 psi; 1 psi divisions above 0 psi), silicone dampened.
  13. Steam (16 to 60 psig): 30 inches Hg vacuum-100 PSIG, silicone dampened.
  14. Range for Fluids under Pressure: 1-1/2 times expected working pressure. If not a standard scale, select next largest scale.
- C. Pressure-Gage Fittings:
1. Valves: NPS 1/4 brass ball type.
  2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
  3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

### 2.05 TEST PLUGS

- A. Manufacturers:

1. Peterson Equipment Co., Inc.
  2. Miljoco Corporation.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.
- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F for cold services, and 500 psig at 275 deg F for hot services.
- D. Core Inserts: One or two self-sealing rubber valves.
1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be Neoprene.
  2. Insert material for air or water service at minus 30 to plus 275 deg F shall be Nordel.
- E. Test Kit: Furnish test kit(s) containing one pressure gage and adaptor, thermometer(s), and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
  2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
  3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
  4. Carrying case shall have formed instrument padding.

### **PART 3 EXECUTION**

#### **3.01 THERMOMETER APPLICATIONS**

- A. Install liquid-in-glass thermometers in the following locations:
1. Inlet and outlet of each hydronic zone.
  2. Inlet and outlet of each hydronic boiler.
  3. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
  4. Inlet and outlet of each hydronic heat exchanger.
  5. Outside-air, return-air, and mixed-air ducts.
- B. Provide the following temperature ranges for thermometers:
1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
  2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions.
  3. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
  4. Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.
  5. Domestic Cold Water: 30 to 130 deg F or 0 to 120 deg F.
  6. Domestic Hot Water: 30 to 180 deg F.
  7. Chilled Water/Condenser Water: 30 to 130 deg F or 0 to 120 Deg F.
  8. Heating Water: 30 to 240 deg F.
  9. All Other locations: As indicated on Drawings.

#### **3.02 GAGE APPLICATIONS**

- A. Install dry-case-type pressure gages on inlet and outlet of each pressure-reducing valve.
- B. Install dry-case-type pressure gages at suction and discharge of each pump.
- C. Except where noted otherwise, select range for twice normal operating pressure.
1. Water (CW and HW): 0 to 100 psig.
  2. Compressed Air: 0 to 100 psig.

#### **3.03 INSTALLATIONS**

- A. Install direct-mounting thermometers and adjust vertical and tilted positions.
- B. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees where thermometers are indicated.
- C. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.
- D. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- E. Install ball valve and snubber fitting in piping for each pressure gage for fluids (except steam).
- F. Install ball valve and syphon fitting in piping for each pressure gage for steam.

- G. Install test plugs in tees in piping.
- H. Install flow indicators, in accessible positions for easy viewing, in piping systems.
- I. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.
- J. Install permanent indicators on walls or brackets in accessible and readable positions.
- K. Install connection fittings for attachment to portable indicators in accessible locations.

#### **3.04 CONNECTIONS**

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

#### **3.05 ADJUSTING**

- A. Calibrate meters according to manufacturer's written instructions, after installation.
- B. Adjust faces of meters and gages to proper angle for best visibility.

**END OF SECTION**

**SECTION 20 05 29 - HANGERS AND SUPPORTS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 PERFORMANCE REQUIREMENTS ..... 1  
1.4 SUBMITTALS ..... 1  
1.5 QUALITY ASSURANCE ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 MANUFACTURERS ..... 2  
2.2 HANGER ROD MATERIAL ..... 2  
2.3 STEEL PIPE HANGERS AND SUPPORTS ..... 2  
2.4 TRAPEZE PIPE HANGERS ..... 2  
2.5 METAL FRAMING SYSTEMS ..... 2  
2.6 METAL INSULATION SHIELDS ..... 3  
2.7 PIPE COVERING PROTECTION SADDLES ..... 3  
2.8 PLASTIC INSULATION SHIELDS ..... 3  
2.9 THERMAL-HANGER SHIELDS ..... 3  
2.10 FASTENER SYSTEMS ..... 4  
2.11 MISCELLANEOUS MATERIALS ..... 4  
PART 3 - EXECUTION ..... 5  
3.1 HANGER AND SUPPORT APPLICATIONS ..... 5  
3.2 HANGER AND SUPPORT INSTALLATION ..... 6  
3.3 EQUIPMENT SUPPORTS ..... 8  
3.4 METAL FABRICATIONS ..... 8  
3.5 ADJUSTING ..... 8  
3.6 PAINTING ..... 8

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment support.
  - 2. Division 20 Section "Mechanical General Requirements."
  - 3. Division 20 Section "Basic Mechanical Materials and Methods."
  - 4. Division 20 Section "Mechanical Vibration Controls" for vibration isolation devices.

**1.02 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. MFMA: Metal Framing Manufacturers Association.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

**1.04 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
- 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. Pipe stands. Include Product Data for components.
  - 4. Equipment supports.
- C. Welding certificates.

### **1.05 QUALITY ASSURANCE**

- A. MSS Standards: Pipe hangers, supports, and accessories shall comply with the following:
  - 1. MSS SP-58, Pipe Hangers and Supports – Materials, Design and Manufacture.
  - 2. MSS SP-69, Pipe Hangers and Supports – Selection and Application.
  - 3. MSS SP-89, Pipe Hangers and Supports – Fabrication and Installation Practices.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.2, "Structural Welding Code--Aluminum."
  - 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
  - 4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  - 5. ASME Boiler and Pressure Vessel Code: Section IX.

## **PART 2 PRODUCTS**

### **2.01 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.

### **2.02 HANGER ROD MATERIAL**

- A. Threaded, hot rolled, steel rod conforming to ASTM A 36 or A575.
  - 1. Rod continuously threaded.
  - 2. Use of rod couplings is prohibited.

### **2.03 STEEL PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-69, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article, and schedules and details on the Drawings for where to use specific hanger and support types.
  - 1. Hangers and Supports for Fire Protection Piping: UL listed or FMG approved.
- B. Manufacturers:
  - 1. Anvil International, Inc.
  - 2. B-Line by Eaton.
  - 3. Carpenter & Paterson, Inc.
  - 4. Hilti USA.
  - 5. ERICO International Corp.
  - 6. PHD Manufacturing, Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### **2.04 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.

### **2.05 METAL FRAMING SYSTEMS**

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers:
  - 1. Anvil International, Inc.; Anvil-Strut.
  - 2. B-Line by Eaton.
  - 3. Power-Strut Div.; Tyco International, Ltd.
  - 4. Unistrut Corp.; Tyco International, Ltd.
  - 5. Hilti USA.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.



- E. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## **2.06 METAL INSULATION SHIELDS**

- A. Manufacturers:
1. Anvil International, Inc.
  2. B-Line by Eaton.
  3. Carpenter & Paterson, Inc.
  4. ERICO International Corp.
  5. PHD Manufacturing, Inc.
- B. Description: MSS SP-69, Type 40, protective shields. Shields shall span an arc of 180 degrees.
- C. Shield Dimensions for Pipe: Not less than the following:
1. NPS 1/4 to NPS 2: 12 inches long and 0.048 inch thick.

## **2.07 PIPE COVERING PROTECTION SADDLES**

- A. Manufacturers:
1. Anvil International, Inc.
  2. B-Line by Eaton.
  3. Carpenter & Paterson, Inc.
  4. ERICO International Corp.
  5. PHD Manufacturing, Inc.
- B. Description: MSS SP-69, Type 39A and Type 39B, for suspension of insulated hot pipe where heat losses are to be kept to a minimum.
1. Saddles shall match insulation thickness.
  2. Saddle length: 12 inches.
  3. Furnish with center rib for pipe sized NPS 12 and larger.

## **2.08 PLASTIC INSULATION SHIELDS**

- A. Manufacturers:
1. B-Line by Eaton; Snap'N Shield.
- B. Description: Polypropylene copolymer protective shields designed to snap directly onto strut channel. Shields shall span an arc of 180 degrees.
1. Operating Temperature Range: Minus 40 deg F to plus 178 deg F.
- C. Certifications:
1. UL Classified for USA: UL-723 (ASTM E 84).
  2. UL listed for Canada: ULC-S102.2.
  3. Meets UL94 HB flammability standards.
- D. Shield Dimensions for Pipe: Not less than the following:
1. NPS 1/4 to NPS 2: 12 inches long.

## **2.09 THERMAL-HANGER SHIELDS**

- A. Manufacturers:
1. B-Line by Eaton.
  2. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
  3. Rilco Manufacturing Company, Inc.
  4. American Mechanical Insulation Sales Inc. (AMIS).
  5. ERICO International Corp.
  6. Value Engineered Products, Inc.
- B. Description: Manufactured assembly consisting of insulation insert encased in 360 degree sheet metal shield.
1. Minimum Compressive Strength of Insert Material:
    - a. 100-psig- for sizes smaller than NPS 6.
    - b. 600-psig- for sizes NPS 6 and larger.
- C. Insulation-Insert Material for Cold Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Full 360 degree, water-repellent treated, ASTM C 533, Type I calcium silicate.

- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.
- F. Include carbon steel ASTM A36 load distribution plates as required by load, pipe movement, hanger style, and hanger spacing.
- G. Thermal-Hanger Shields for Flexible Foamed Elastomeric Insulated Piping:
  - 1. Manufacturer:
    - a. B-Line by Eaton/Armacell; Armafix IPH.
  - 2. Insulation-Insert Material for Copper Piping with Flexible Foamed Elastomeric Insulation: Use the following:
    - a. Flexible foamed elastomeric, ASTM 534, Type I-Tubular Grade 1 with PUR/PIP support inserts.
- H. Thermal-Hanger Shields for Small Diameter Piping:
  - 1. Manufacturer:
    - a. Hydra-Zorb Company; Klo-Shure Insulation Couplings.
  - 2. Insulation-Insert Material for Small Diameter Piping with Flexible Foamed Elastomeric or Glass Fiber Insulation: Use the following:
    - a. Rigid Hytrel thermoplastic insulation coupling designed for use with pipe or tube NPS 1-1/2 and smaller, and insulation from 3/8 inch to 1-1/2 inch thick.

## 2.10 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line by Eaton.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.
- B. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application. Exception: Do not use chemical fasteners to support hanger systems for fire protection piping.
  - 1. Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.
    - c. MKT Fastening, LLC.
    - d. Powers Fasteners.
  - 2. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
  - 3. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
  - 4. Washer and Nut: Zinc-coated steel.
- C. Threaded Inserts: Galvanized malleable iron or galvanized steel for 3/4 inch bolts.
  - 1. Manufacturers:
    - a. Superior Concrete Accessories; Threaded Insert.
    - b. Dayton Sure-Grip and Shore Co.
    - c. Richmond Screw Anchor Co.
- D. Slotted Inserts: Continuous galvanized steel with temporary slot fillers and complete with nuts, studs, washers and the like, for 3/4 inch bolts.
  - 1. Manufacturers:
    - a. B-Line by Eaton; B22-I Continuous Concrete Insert.
    - b. Unistrut Corp.; P-3200 Continuous Insert.
    - c. Hohman and Barnard, Inc.
    - d. Richmond Screw Anchor Co.
    - e. Hilti, Inc.; CIS13812/PG.

## 2.11 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Non-staining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

### **PART 3 EXECUTION**

#### **3.01 HANGER AND SUPPORT APPLICATIONS**

- A. Refer to application schedules on the Drawings.
- B. For insulated pipe, oversize hanger elements to accommodate insulation thickness.
- C. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- D. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- E. Use hangers and supports with galvanized, metallic coatings for outdoor applications or where exposed to outdoor conditions.
- F. Use hangers and supports with plastic coating, or galvanized metallic coatings for applications in corrosive atmospheres.
- G. Use metal framing, with plastic coating, or galvanized metallic coatings for metal framing in corrosive atmospheres.
- H. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- I. Use padded hangers for piping that is subject to scratching.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. MSS Type 8 or spring type to meet system requirements.
- 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.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Concrete Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Anchor Devices, Concrete and Masonry: in accordance with Group I, Group II, Type 2, Class 2, Style 1 and Style 2, Group III and Group VIII or FS FF-S-325A. Furnish cast-in floor type equipment anchor devices with adjustable positions. Furnish built in anchor devices for masonry, unless otherwise approved by the Architect. Powder actuated anchoring devices shall not be used to support any mechanical systems components.
  - 2. Inserts, Concrete: TYPE 18 or 19. When applied to loads equivalent to piping in sizes NPS 2 and larger, and where otherwise required by imposed loads, a one foot length of 1/2 inch NPS 4 reinforcing rod shall be inserted and wired through wing slots. Proprietary type continuous inserts may be proposed and shall be submitted for approval.
  - 3. Use mechanical-expansion anchors where required in concrete construction.
  - 4. Use chemical fasteners where required in concrete construction.
- M. Steel Frame Structure Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Beam Clamps:
    - a. Center Loading: TYPE 21, 28, 29 and 30, unless otherwise indicated. Type 27 shall be allowed to support single pipes NPS 6 size or smaller only.
    - b. "C" Clamps: Type 19, 20 or 23, for supporting single pipes NPS 2-1/2 size or smaller only. Use of "C" clamps, or beam clamps of "C" pattern, or any modification thereof, is prohibited for supporting multiple pipes or pipes larger than NPS 2-1/2.

- N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Use spring supports and sway braces TYPES 48, 49, 50, 51, 52, 53, 54, 55 or 56. For specific points:
    - a. Provide spring supports at point of support where vertical movement will occur.
    - b. For light loads and vertical movement less than 1/4 inch, TYPES 48 or 49 spring cushion supports.
    - c. For vertical movements in excess of 1/4 inch but less than 1/2 inch, TYPES 51, 52 or 53 variable spring supports shall be used, loaded to not more than 75 percent of published load rating.
    - d. For vertical movements of 1/2 inch and more, TYPES 54, 55 and 56 constant support spring hangers.
    - e. Sway braces; TYPE 50.
    - f. Variable spring hangers in accordance with referenced MSS Standards with "medium" allowable load change.
- O. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

### 3.02 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 structural frame.
- B. Provide necessary piping and equipment supporting elements including: building structure attachments, supplementary steel, hanger rods, stanchions and fixtures, vertical pipe attachments, horizontal pipe attachments, anchors, guides, spring supports in accordance with the referenced codes, standards, and requirements specified. Support piping and equipment from building structure, not from roof deck, floor slab, other pipe, duct or equipment.
- C. At connections between piping systems, hangers and equipment of dissimilar metals, insulate, using dielectric insulating material, nonferrous piping against direct contact with the building steel by insulating the contact point of the hanger and pipe or the hanger and building steel. Test each point of dielectric insulation with an ohm meter to ensure proper isolation of dissimilar materials. Test shall be observed by the Owner's Representative and/or Architect.
- D. Use copper plated or plastic coated supporting element in contact with copper tubing or glass piping.
- E. File and paint cut ends and shop or field prime paint supporting element components.
- F. Hang piping parallel with the lines of the building, unless otherwise indicated. Route piping in an orderly manner and maintain gradient. Space piping and components so a threaded pipe fitting may be removed between adjacent pipes and so there will be not less than 1/2 inch of clear space between finished surfaces and piping. Arrange hangers on adjacent parallel service lines in line with each other.
- G. Flange loads on connected equipment shall not exceed 75 percent of maximum allowed by equipment manufacturer. Flange loads in liquid containing systems shall be checked in the presence of the Architect when piping is full of liquid. No flange load is allowed on pumps, vibration isolated equipment or flexible connectors.
- H. Spring supports, within specified limitations: Constant support type, where necessary to avoid transfer of load from support to support or onto connected equipment; otherwise, variable support type located at points subject to vertical movement.
- I. Incorporate pipe anchors into piping systems to maintain permanent pipe positions. Install alignment guides for the piping adjacent to and on each side of pipe expansion loops and expansion joints to maintain alignment.
- J. Where necessary, brace piping and supports against reaction, sway and vibration.
- K. Do not hang piping from joist pans, floor decks, roof decks, equipment, ductwork, or other piping.
- L. Install turnbuckles, swing eyes and clevises to accommodate temperature changes, pipe accessibility, and adjustment for load pitch. Rod couplings are not acceptable.
- M. Install hangers and supports for piping at intervals specified, at locations not more than 3 feet from the ends of each runout, not more than 3 feet from connections to equipment, and not over 25 percent of specified interval from each change in direction of piping and for concentrated loads such as valves, etc.

- N. Base the load rating for pipe support elements on loads imposed by insulated weight of pipe filled with water. The span deflection shall not exceed slope gradient of pipe.
- O. If structural steel, roofs, or tunnels will allow support spacing greater than that shown above, Contractor shall submit proposed support system along with structural calculations documenting the allowance of such spacing, in accordance with ANSI, B31.1, and MSS Guidelines.
- P. Support vertical risers independently of connected horizontal piping whenever practical, with supports at the base and at intervals to accommodate system range of load with thermal conditions. Support vertical risers at each floor penetration for piping in shafts or chases. Guide for lateral stability. Fit horizontal piping connected to moving risers with two spring supports connected adjacent to riser, spaced according to required hanger spacing.
- Q. For risers at temperatures of 100 deg F or less place riser clamps under fittings. Support carbon steel pipe at each operating level or floor and at not more than 15-foot intervals for pipe 2 inches and smaller, and at not more than 20 foot intervals for pipe 2-1/2 inches and larger.
- R. After the piping systems have been installed, tested and placed in satisfactory operation, firmly tighten hanger rod nut and jam nut and upset threads to prevent movement of fasteners.
- S. Attach pipe anchors and pipe alignment guides to the building structure where indicated. If not indicated, the method used is optional to the Contractor, subject to approval by the Architect. In the case of structural steel, make attachment by clamping in accordance with the American Institute of Steel Construction Specification for the Design, Fabrication and Erection of Structural Steel for Building.
- T. Attach supporting elements connected to structural steel columns to preclude vertical slippage and cascading failure.
- U. Attach pipe hangers and other supporting elements to roof purlins and trusses at panel points.
- V. Where eccentric loading beam clamps are approved and where other work is supported by similar eccentric loading support element from the same structural member, locate eccentric loading support elements to minimize structural member torsion load.
- W. Limit the location of supporting elements for piping and equipment, when supported from roof, to panel points of the bar joists.
- X. Building structure shall not be reinforced except as approved by the Architect in writing.
- Y. Use approved cast-in-place inserts or built-in anchors for attachment to concrete structure. Size inserts and anchors for the total applied load with a safety factor in accordance with applicable codes but in no case less than 5. Coordinate installation of all imbedded items in accordance with manufacturer's instructions. Position anchorage and imbedded items as indicated and/or where required and support against displacement during placing of concrete. Cutting or repositioning of concrete beam or girder or reinforcing steel to accommodate inserts will not be allowed. Provide removable closures in imbedded device openings to prevent entry of concrete.
- Z. Support piping and equipment from concrete building frame, not from roof or floor slabs unless otherwise indicated.
- AA. Use cast-in-place inserts in concrete beams and girders. Drilled anchors/wedge type inserts shall be used on vertical surfaces only. Coordinate with structural engineer.
- BB. Attach piping supports to the side of concrete beams and concrete joist. Provide supplementary support steel as required. Cast-in-place or drilled anchors will not be permitted in the bottom of concrete beams and concrete joist.
- CC. Attach piping supports to the side of concrete beams or concrete joist. Where intermediate hangers are required to meet the hanger spacing schedule, the Contractor may propose attachment of intermediate pipe supports to the bottom of the concrete slab pending submittal of a satisfactory pull out test. The Contractor shall submit pull out test criteria, pull out test results, proposed hanger detail and hanger point loads to the Architect for written approval.
- DD. 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.
- EE. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- FF. Fastener System Installation:
  - 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- GG. Roof-Mounting Pipe and Equipment Stand Installation:
  - 1. Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  - 2. Curb or Rail Mounting Type Stands: Assemble components or fabricate stand and mount on permanent, stationary roof curb or rail. Refer to Division 07 Section "Roof Accessories" for curb and rail installation.
  - 3. Maintain support manufacturer's recommended spacing.
- HH. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- II. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- JJ. 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.
- KK. Install lateral bracing with pipe hangers and supports to prevent swaying.
- LL. 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.
- MM. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- NN. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- OO. Refer to individual piping sections for hanger spacing and hanger rod sizes.

### 3.03 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.

### 3.04 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.

### 3.05 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.

### 3.06 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. Equipment Supports: Painting is specified in Division 09 painting Sections.
- C. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**

This page intentionally left blank



**SECTION 20 05 47 - MECHANICAL VIBRATION CONTROLS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUBMITTALS ..... 1  
1.3 QUALITY ASSURANCE ..... 1  
1.4 COORDINATION ..... 1  
PART 2 - PRODUCTS ..... 1  
2.1 VIBRATION ISOLATION EQUIPMENT BASES ..... 1  
2.2 VIBRATION ISOLATORS ..... 2  
2.3 VIBRATION ISOLATION HANGERS ..... 3  
2.4 FACTORY FINISHES ..... 4  
PART 3 - EXECUTION ..... 4  
3.1 EXAMINATION ..... 4  
3.2 INSTALLATION ..... 4  
3.3 CONNECTIONS ..... 4  
3.4 EQUIPMENT BASES ..... 5  
3.5 FIELD QUALITY CONTROL ..... 5  
3.6 ADJUSTING ..... 5  
3.7 CLEANING ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 SUBMITTALS**

- A. Product Data: Include load deflection curves for each vibration isolation device.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, and spring deflection changes. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
- C. Welding certificates.

**1.03 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

**1.04 COORDINATION**

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Installation of these items is specified in Division 07 Section "Roof Accessories."

**PART 2 PRODUCTS**

**2.01 VIBRATION ISOLATION EQUIPMENT BASES**

- A. **Type A:** Direct Isolator Attachment
  - 1. Unit to be isolated is so constructed that vibration isolators of the type specified may be directly attached, provided that the edge deflection of the isolated unit base over unsupported span between mountings does not exceed specified or manufacturer's limits. If units to be isolated will not meet required deflection provisions, Type B bases shall be provided.

- B. **Type B:** Factory-fabricated, welded, structural-steel bases or rails.
1. Structural Steel Bases:
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type WF or a comparable product by one of the following:
      - 1) Amber/Booth; a VMC Group Company.
      - 2) Kinetics Noise Control, Inc.
      - 3) Korfund Dynamics; a VMC Group Company.
      - 4) Vibration Eliminator Co., Inc.
      - 5) Vibration Isolation Co., Inc. (Pump Bases Only)
      - 6) Vibration Mountings & Controls; a VMC Group Company.
      - 7) Vibro-Acoustics.
    - b. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
    - c. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
    - d. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
  2. Structural-Steel Rails:
    - a. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type ICS or a comparable product by one of the following:
      - 1) Amber/Booth; a VMC Group Company.
      - 2) Kinetics Noise Control, Inc.
      - 3) Korfund Dynamics; a VMC Group Company.
      - 4) Vibration Eliminator Co., Inc.
      - 5) Vibration Isolation Co., Inc. (Pump Bases Only)
      - 6) Vibration Mountings & Controls; a VMC Group Company.
      - 7) Vibro-Acoustics.
    - b. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
    - c. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
    - d. Support Brackets: Factory-welded steel angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

## 2.02 VIBRATION ISOLATORS

- A. **Type 1a** Elastomeric Isolator Pads: Oil- and water-resistant elastomer, arranged in single or multiple layers (maximum 3 layers separated by steel shims) to achieve 90 percent efficiency, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type W, Super W, WSW, and WSWSW or comparable products by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Material: Standard neoprene for indoor applications.
  3. Material: Bridge-bearing neoprene, complying with AASHTO M 251 for outdoor applications.
- B. **Type 1b** Elastomeric Isolator Pads: Oil- and water-resistant elastomer, single layer, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and 1/4 inch steel load bearing plate. Factory cut to sizes that match requirements of supported equipment.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type Super WMSW and MBSW or a comparable product by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.

- e. Vibration Mountings & Controls; a VMC Group Company.
  - f. Vibro-Acoustics.
  2. Material: Standard neoprene for indoor applications.
  3. Material: Bridge-bearing neoprene, complying with AASHTO M 251 for outdoor applications.
- C. **Type 2** Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type ND or a comparable product by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Durometer Rating: Selected for maximum possible static deflection with the loading of each piece of equipment.
  3. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
  4. Neoprene: Bridge-bearing neoprene as defined by AASHTO.
- D. **Type 4** Restrained Spring Isolators: Restrained single and multiple spring mounts.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Types SLR and SLRS or comparable products by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  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. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

### 2.03 VIBRATION ISOLATION HANGERS

- A. **Type 8a** Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type 30N or a comparable product by one of the following:
    - a. Amber/Booth; a VMC Group Company.
    - b. Kinetics Noise Control, Inc.
    - c. Korfund Dynamics; a VMC Group Company.
    - d. Vibration Eliminator Co., Inc.
    - e. Vibration Mountings & Controls; a VMC Group Company.
    - f. Vibro-Acoustics.
  2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
  3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  5. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
  6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- B. **Type 8b** Spring Hangers with Vertical-Limit Stop: Pre-compressed combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mason Industries, Inc.; Type PC30N or a comparable product by one of the following:
  - a. Amber/Booth; a VMC Group Company.
  - b. Kinetics Noise Control, Inc.
  - c. Korfund Dynamics; a VMC Group Company.
  - d. Vibration Eliminator Co., Inc.
  - e. Vibration Mountings & Controls; a VMC Group Company.
  - f. Vibro-Acoustics.
2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

#### **2.04 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 electrogalvanized. Hot-dip galvanize metal components for exterior use.
  3. Baked enamel for metal components on isolators for interior use.
  4. Color-code or otherwise mark vibration isolation devices to indicate capacity range.

#### **PART 3 EXECUTION**

##### **3.01 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation devices for compliance with requirements, 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.

##### **3.02 INSTALLATION**

- A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 07 Section "Roof Accessories."
- B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

##### **3.03 CONNECTIONS**

- A. Provide flexible electrical connections in the form of large radius, 360 degree loop of flexible conduit for all vibrating isolated equipment. Any cooling water lines, compressed air, or other piping services (except inlet and outlet water connections for pumps, chillers or cooling tower) shall be made with 360 degree loops of reinforced neoprene hose, which are attached using nipples of appropriate gender. All service connections made with neoprene hose shall have shut-off valves between the hose and the supply service.
- B. Vibration isolate piping connected to vibration isolated equipment using Type 8a or 8b spring hangers, and with distance to be isolated as scheduled on the Drawings. Maximum spacing between isolators same as maximum distance between pipe hangers and supports.
- C. Vibration isolate ductwork connected to air handling units, return air fans, and vibration isolated equipment using Type 8a or 8b spring hangers, and in accordance with isolation distances scheduled on the Drawings.

### **3.04 EQUIPMENT BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to supported equipment manufacturer's written instructions.
  - 1. 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.
  - 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

### **3.05 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  - 1. Isolator deflection.
  - 2. Snubber minimum clearances.

### **3.06 ADJUSTING**

- A. Adjust isolators after piping systems have been filled and 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. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust active height of spring isolators.
- E. Adjust snubbers according to manufacturer's written recommendations.

### **3.07 CLEANING**

- A. After completing equipment installation, inspect vibration isolation devices. Remove paint splatters and other spots, dirt, and debris.

**END OF SECTION**

This page intentionally left blank

**SECTION 20 05 53 - MECHANICAL IDENTIFICATION**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUBMITTALS ..... 1  
1.3 QUALITY ASSURANCE ..... 1  
1.4 COORDINATION ..... 1  
PART 2 - PRODUCTS ..... 1  
2.1 MANUFACTURERS ..... 1  
2.2 EQUIPMENT IDENTIFICATION DEVICES ..... 1  
2.3 PIPING IDENTIFICATION DEVICES ..... 2  
PART 3 - EXECUTION ..... 2  
3.1 APPLICATIONS, GENERAL ..... 2  
3.2 EQUIPMENT IDENTIFICATION ..... 3  
3.3 PIPING IDENTIFICATION ..... 3  
3.4 ADJUSTING ..... 4  
3.5 CLEANING ..... 4  
3.6 SCHEDULES ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."

**1.02 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in Maintenance Manuals.

**1.03 QUALITY ASSURANCE**

- A. ASME Compliance: Comply with ASME (ANSI) A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

**1.04 COORDINATION**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified:
  - 1. Seton.
  - 2. Brady.
  - 3. EMED.
  - 4. Craftmark.
  - 5. Brimar Industries, Inc.
  - 6. Marking Services Inc. (MSI).
  - 7. Kolbi Pipe Marker Co.

**2.02 EQUIPMENT IDENTIFICATION DEVICES**

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:

- a. Manufacturer, product name, model number, and serial number.
  - b. Capacity, operating and power characteristics, and essential data.
  - c. Labels of tested compliances.
  2. Location: Accessible and visible.
  3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
1. Terminology: Match schedules as closely as possible.
  2. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Data: Instructions for operation of equipment and for safety procedures.
  2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  3. Thickness: Minimum 1/16 inch, unless otherwise indicated.
  4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

### **2.03 PIPING IDENTIFICATION DEVICES**

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
1. Colors: Comply with ASME (ANSI) A13.1, unless otherwise indicated.
  2. Type and Size of Letters: Comply with ANSI A13.1, unless otherwise indicated.
  3. Legends: Spelled out in full or commonly used and accepted abbreviations.
  4. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  5. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  6. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pre-tensioned Pipe Markers: Pre-coiled semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.
- F. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4mil thick, manufactured for direct burial service.
- G. Detectable Underground Pipe Markers: Continuously printed plastic ribbon tape with detectable aluminum core and with colors meeting APWA requirements, not less than 6 inches wide by 4 mil thick, manufactured for direct burial service.

## **PART 3 EXECUTION**

### **3.01 APPLICATIONS, GENERAL**

- A. Products specified are for applications referenced in other Division 20, 21, 22, and 23 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.



### 3.02 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
  2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
  4. Fans, blowers, primary balancing dampers, and mixing boxes.
  5. Packaged HVAC central-station and zone-type units including heat pumps located in mechanical rooms.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 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.
  2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Fire department hose valves and hose stations.
    - c. Meters, gages, thermometers, and similar units.
    - d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    - e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    - g. Fans, blowers, primary balancing dampers, and mixing boxes.
    - h. Packaged HVAC central-station and zone-type units.
    - i. Tanks and pressure vessels.
    - j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install access panel markers with screws on equipment access panels.
- D. Area Served: Equipment serving different areas of a building other than where the equipment is installed shall be permanently marked in a manner that, in addition to identifying the equipment as specified in this Section, also identifies the area it serves.

### 3.03 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
1. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
  2. Pipes with OD, Including Insulation, 6 Inches and Larger: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, minimum 1-1/2 inches wide, lapped at least 3 inches at both ends of pipe marker, and covering full circumference of pipe.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed 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 nonaccessible 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 markers.

C. Underground Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

**3.04 ADJUSTING**

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

**3.05 CLEANING**

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

**3.06 SCHEDULES**

A. Paint colors are listed here for reference only. Painting is specified under Division 9.

**PIPE LABELING AND COLOR CODING**

<u>Pipe System Label</u>	<u>Drawing Abbrev.</u>	<u>Labels</u>	<u>Piping</u>
Sanitary Sewer	SAN	White on Green	Dark Brown
Sanitary Vent	V	White on Green	Dark Brown
Rain Conductor	RC	White on Green	Dark Brown
Acid Waste	AW	Black on Yellow	Black
Acid Vent	AV	Black on Yellow	Black
Domestic Cold Water	CW	White on Green	Light Green
Domestic Hot Water	HW	Black on Yellow	Dark Green
Domestic Hot Water Return	HWR	Black on Yellow	Dark Green
Natural Gas	G	Black on Yellow	Yellow
Compressed Air (90psig)	A(90psig)	Black on Yellow	Dark Blue
Compressed Air (25psig)	A	White on Green	Dark Blue
Hot Water Htg. Supply	HWHS	Black on Yellow	Dark Blue
Hot Water Htg. Return	HWHR	Black on Yellow	Dark Blue
Heat Pump Loop Water Supply	HPLWS	White on Green	Light Blue
Heat Pump Loop Water Return	HPLWR	White on Green	Light Blue
Refrigerant Liquid	RL	Black on Yellow	
Refrigerant Suction	RS	Black on Yellow	
Fire Protection	FP	White on Red	Bright Red

**END OF SECTION**

**SECTION 20 07 00 - MECHANICAL INSULATION**

PART 1 - GENERAL .....	1
1.1 RELATED DOCUMENTS .....	1
1.2 SUMMARY .....	1
1.3 DEFINITIONS .....	1
1.4 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION .....	2
1.5 FIELD-APPLIED JACKETING SYSTEMS DESCRIPTION .....	2
1.6 SUBMITTALS .....	2
1.7 QUALITY ASSURANCE .....	2
1.8 DELIVERY, STORAGE, AND HANDLING .....	2
1.9 COORDINATION .....	2
1.10 SCHEDULING .....	3
PART 2 - PRODUCTS .....	3
2.1 INSULATION MATERIALS, GENERAL REQUIREMENTS .....	3
2.2 PIPE INSULATION MATERIALS .....	3
2.3 DUCTWORK INSULATION MATERIALS .....	3
2.4 INSULATING CEMENTS .....	3
2.5 ADHESIVES .....	4
2.6 MASTICS .....	4
2.7 SEALANTS .....	5
2.8 FACTORY-APPLIED JACKETS .....	5
2.9 FIELD-APPLIED FABRIC-REINFORCING MESH .....	6
2.10 FIELD-APPLIED CLOTHS .....	6
2.11 FIELD-APPLIED JACKETS .....	6
2.12 REMOVABLE AND REUSABLE INSULATION COVERS .....	8
2.13 TAPES .....	8
2.14 SECUREMENTS .....	9
PART 3 - EXECUTION .....	10
3.1 EXAMINATION .....	10
3.2 PREPARATION .....	11
3.3 COMMON INSTALLATION REQUIREMENTS .....	11
3.4 PENETRATIONS .....	12
3.5 GENERAL PIPE INSULATION INSTALLATION .....	12
3.6 GLASS-FIBER PIPE INSULATION INSTALLATION .....	13
3.7 FLEXIBLE ELASTOMERIC PIPE INSULATION INSTALLATION .....	15
3.8 DUCT AND PLENUM INSULATION INSTALLATION .....	15
3.9 FINISHES .....	16

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Materials and Methods."
  - 3. Division 20 Section "Hanger and Supports" for thermal hanger shield inserts.

**1.02 SUMMARY**

- A. This Section includes mechanical insulation for pipe, duct, and equipment.

**1.03 DEFINITIONS**

- A. ASJ: All-service jacket.
- B. FSK: Foil, scrim, kraft paper.
- C. FSP: Foil, scrim, polyethylene.
- D. PVC: Polyvinyl Chloride.
- E. PVDC: Polyvinylidene chloride.
- F. SSL: Self-sealing lap.

#### **1.04 INDOOR PIPING INSULATION SYSTEMS DESCRIPTION**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are scheduled on the Drawings, or identified for each piping system and pipe size range.
- B. Sanitary Waste Piping Where Heat Tracing Is Installed, All Pipe Sizes: Glass-Fiber Pipe Insulation, Type I: 1-1/2 inches thick.

#### **1.05 FIELD-APPLIED JACKETING SYSTEMS DESCRIPTION**

- A. Acceptable field-applied jacketing materials and thicknesses are scheduled on the Drawings.
- B. Outdoor Piping or Equipment: Aluminum, Stucco Embossed: 0.016 inch thick; or minimum 14.5 mil thick self-adhesive outdoor jacket.

#### **1.06 SUBMITTALS**

- A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).
  - 1. ESR Report: For fire-rated grease duct insulation.
- B. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Attachment and covering of heat tracing inside insulation.
  - 3. Insulation application at pipe expansion joints for each type of insulation.
  - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Application of field-applied jackets.
  - 7. Application at linkages of control devices.
  - 8. Field application for each equipment type
  - 9. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- C. Field quality-control inspection reports.

#### **1.07 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Prior to installation, protect insulation from exposure to water and from physical damage. Prior to installation, store insulation in manufacturer's original packaging.

#### **1.09 COORDINATION**

- A. Coordinate size and location of supports, hangers, and pre-insulated pipe shields/supports specified in Division 20 Section "Hangers and Supports."
- B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.10 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 PRODUCTS

### 2.01 INSULATION MATERIALS, GENERAL REQUIREMENTS

- 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.
- E. Adhesives used shall be fire resistant in their dry states and UL listed.

### 2.02 PIPE INSULATION MATERIALS

- A. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Aeroflex USA, Inc.; Aerocel Tube and Sheet.
    - b. Armacell LLC; AP Armaflex.
    - c. IK Insulation Group; K-Flex USA LLC; Insul-Tube and Insul-Sheet.
- B. Glass-Fiber, Preformed Pipe Insulation, Type I:
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation; 1000 Pipe Insulation.
    - c. Manson Insulation Inc.; Alley-K.
    - d. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F Materials: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

### 2.03 DUCTWORK INSULATION MATERIALS

- A. Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite EQ.
    - c. Knauf Insulation; Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap FSK.
    - e. Owens Corning; All-Service Duct Wrap.

### 2.04 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Insulco, Division of MFS, Inc.; Triple I.
    - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. P. K. Insulation Mfg. Co., Inc.; Thermal-V-Kote.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Insulco, Division of MFS, Inc.; SmoothKote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.05 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Armacell LCC; 520 Adhesive.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-75.
    - c. RBX Corporation; Rubatex Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
    - f. Vimasco Corporation.
- D. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-97.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-27/81-93.
    - c. Marathon Industries, Inc.; 290.
    - d. Mon-Eco Industries, Inc.; 22-30.
    - e. Vimasco Corporation; 760.
- E. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
- F. Phenolic-Foam, and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-96.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
    - c. Marathon Industries, Inc.
    - d. Mon-Eco Industries, Inc.
    - e. Vimasco Corporation.
- G. 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. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- H. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Dow Chemical Company (The); 739, Dow Silicone.
    - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Red Devil, Inc.; Celulon Ultra Clear.
    - e. Speedline Corporation; Speedline Vinyl Adhesive.

## 2.06 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. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.
    - f. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-10.
    - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
    - d. Marathon Industries, Inc.; 550.
    - e. Mon-Eco Industries, Inc.; 55-50.
    - f. Vimasco Corporation; WC-1/WC-5.
  2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 200 deg F.
  4. Solids Content: 63 percent by volume and 73 percent by weight.
  5. Color: White.

## 2.07 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-76-8.
    - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
    - c. Marathon Industries, Inc.; 405.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Vimasco Corporation; 750.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: Aluminum.
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-76.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Fire- and water-resistant, flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 40 to plus 250 deg F.
  5. Color: White.
- C. Joint Sealants for Cellular-Glass, Phenolic-Foam, and Polyisocyanurate:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; CP-76.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
    - c. Marathon Industries, Inc.; 405.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
    - f. Vimasco Corporation; 750.
  2. Materials shall be compatible with insulation materials, jackets, and substrates.
  3. Permanently flexible, elastomeric sealant.
  4. Service Temperature Range: Minus 100 to plus 300 deg F.
  5. Color: White or gray.

## 2.08 FACTORY-APPLIED JACKETS

- A. Insulation systems indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## **2.09 FIELD-APPLIED FABRIC-REINFORCING MESH**

- A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Vimasco Corporation; Elastafab 894.
    - b. Or approved equal.
- B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Childers Products, H.B. Fuller Company; Chil-Glas No. 5.
    - b. Or approved equal.
- C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
    - b. Vimasco Corporation; Elastafab 894.

## **2.10 FIELD-APPLIED CLOTHS**

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.
    - b. Lewco Products.
    - c. Mid-Mountain.
    - d. TCI.

## **2.11 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 specified; roll stock ready for shop or field cutting and forming.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Johns Manville; Zeston and Ceel-Co.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto PVC Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. Factory-fabricated tank heads and tank side panels.
- D. PVC Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C, and including flexible glass fiber insulation inserts.
  1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Johns Manville; Zeston and Ceel-Co.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto PVC Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by manufacturer.
  3. Color: White.
  4. Factory-fabricated fitting covers:
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, and mechanical joints.



- E. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; ITW Insulation Systems; Metal Jacketing Systems.
    - b. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick Polysurlyn.
    - e. Factory-Fabricated Fitting Covers:
      - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      - 2) Provide factory fabricated PVC tee covers, flange and union covers, beveled collars and valve covers.
      - 3) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
  3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
    - a. Sheet and roll stock ready for shop or field sizing factory cut and rolled to size.
    - b. Material, finish, and thickness are indicated in field-applied jacket systems.
    - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick Polysurlyn.
    - e. Factory-Fabricated Fitting Covers:
      - 1) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      - 2) Provide factory fabricated PVC tee covers, flange and union covers, beveled collars and valve covers.
      - 3) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- F. Self-Adhesive Outdoor Jacket: 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 aluminum-foil facing.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. MFM Building Products Corp.; FlexClad-400
    - b. Polyguard; Alumaguard.
    - c. Venture Tape Corp.; VentureClad.
- G. 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.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Dow Chemical Company (The), Saran 540 Vapor Retarder Film.
- H. 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.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Dow Chemical Company (The), Saran 560 Vapor Retarder Film.
- I. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
- J. Sound Barrier Jacket: Uni-composite film laminated to 0.020 inch thick stucco embossed aluminum using viscoelastic film adhesive.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; ITW Insulation Systems; 1 pound Muffl-Jac.
  2. Properties:
    - a. Sound Transmission Class (STC): 29.
    - b. Thickness (film): 0.080 to 0.110 inch.
    - c. Weight (film): 1 pound per square foot.
    - d. Service Temperature Range: Minus 40 deg F to 180 deg F.
  3. Proprietary sound jacketing by steam pressure reducing valve manufacturer is also acceptable.

## 2.12 REMOVABLE AND REUSABLE INSULATION COVERS

- A. Flexible Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of 4 inches of high temperature fiberglass insulation compressed between Teflon impregnated fiberglass inner and outer facing stitched with fiberglass core Teflon thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.
  - 1. Fabricators:
    - a. Apex Energy & Environmental Products Inc.
    - b. 3i Supply Co.; K-TEX.
    - c. Valley Group of Companies.
- B. Rigid Style: Custom fabricated composite jackets for valves, flanges, and expansion joints consisting of rigid foam insulation with silicone impregnated fiberglass outer facing stitched with fiberglass thread, and secured with Velcro fasteners and double D-ring cinching. Service temperature range of minus 40 deg F to 500 deg F.
  - 1. Fabricators:
    - a. Valley Group of Companies.

## 2.13 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - b. Compac Corp.; 110 and 111.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
    - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    - d. Venture Tape; 1506 CW NS.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
  - 1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.

- b. Compac Corp.; 120.
  - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
  - d. Venture Tape; 3520 CW.
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
  2. Width: 3 inches.
  3. Film Thickness: 4 mils.
  4. Adhesive Thickness: 1.5 mils.
  5. Elongation at Break: 145 percent.
  6. Tensile Strength: 55 lbf/inch in width.
- F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. Dow Chemical Company (The); Saran 560 Vapor Retarder Tape.
  2. Width: 3 inches.
  3. Film Thickness: 6 mils.
  4. Adhesive Thickness: 1.5 mils.
  5. Elongation at Break: 145 percent.
  6. Tensile Strength: 55 lbf/inch in width.

## 2.14 SECUREMENTS

- A. Bands:
1. Products: Subject to compliance with requirements, provide one of the products specified.
    - a. PABCO-Childers Metals; ITW Insulation Systems; Pab-Bands and Fabstraps.
    - b. RPR Products, Inc.; Bands.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
  4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
    - a. Products: Subject to compliance with requirements, provide one of the products specified.
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; CD.
      - 3) Midwest Fasteners, Inc.; CD.
      - 4) Nelson Stud Welding; TPA, TPC, and TPS.
  2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
    - a. Products: Subject to compliance with requirements, provide one of the products specified.
      - 1) AGM Industries, Inc.; CWP-1.
      - 2) GEMCO; Cupped Head Weld Pin.
      - 3) Midwest Fasteners, Inc.; Cupped Head.
      - 4) Nelson Stud Welding; CHP.
  3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Products: Subject to compliance with requirements, provide one of the products specified.
      - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      - 2) GEMCO; Perforated Base.
      - 3) Midwest Fasteners, Inc.; Spindle.

- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 1) GEMCO; Nylon Hangers.
    - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
    - 2) GEMCO; Press and Peel.
    - 3) Midwest Fasteners, Inc.; Self Stick.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Products: Subject to compliance with requirements, provide one of the products specified.
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- a. Manufacturers:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
- 1. Manufacturers:
    - a. ACS Industries, Inc.
    - b. C & F Wire.
    - c. PABCO-Childers Metals; ITW Insulation Systems.
    - d. RPR Products, Inc.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.03 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at the 4 o'clock or 8 o'clock position on 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 as recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. For services with surface temperatures below ambient, install a continuous unbroken vapor barrier. 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 thermal hanger 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 thermal hanger 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 the 4 o'clock or 8 o'clock position on the pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  5. For below ambient services, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness. Where compression of insulation is possible, fabricate/install insulation per manufacturer's recommendations.
- 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.

### 3.04 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations that Are Not Fire Rated: Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations:
1. Terminate ductwork insulation at angle closure of fire damper sleeves.
  2. Install pipe insulation continuously through penetrations of fire-rated walls and partitions.
    - a. Firestopping is specified in Division 07 Section "Through-Penetration Firestop Systems."
- F. Insulation Installation at Floor Penetrations:
1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at angle closure of fire damper sleeves.
  2. Pipe: Install insulation continuously through floor penetrations.
    - a. Seal penetrations through fire-rated assemblies according to Division 07 Section "Through-Penetration Firestop Systems."

### 3.05 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible Elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union 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.
- E. Install removable and reusable insulation covers in accordance with fabricator's instructions, and at the following locations:

### 3.06 GLASS-FIBER PIPE INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  3. For piping systems with surface temperatures below ambient, install a continuous unbroken vapor barrier. Seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
    - a. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
    - b. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
- B. Insulation Installation on Pipe Flanges:
1. Install PVC fitting covers when available.
  2. When PVC fitting covers are not available, install preformed pipe insulation to outer diameter of pipe flange:
    - a. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
    - b. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass or mineral wool blanket insulation as specified for system.
  3. 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 PVC fitting covers when available.
  2. When PVC fitting covers are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install PVC fitting covers when available.
  2. When PVC fitting covers are not available, install mitered sections of pipe insulation to valve body.
  3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  4. Install insulation to flanges as specified for flange insulation application.
- E. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- F. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers' 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.
  2. For services with surface temperatures below ambient, maintain continuous unbroken vapor barrier.
- G. 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.
- H. Where sound barrier jackets are indicated, install in accordance with manufacturer's instructions.
- I. 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-pre-sized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install pre-sized 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 "fish mouthing," 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.

### **3.07 FLEXIBLE ELASTOMERIC PIPE 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.

### **3.08 DUCT AND PLENUM INSULATION INSTALLATION**

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.
  1. 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 over compress 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.
  2. 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 1 edge and 1 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 2 times the insulation thickness but not less than 3 inches.
  3. 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.
  4. 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.
  5. 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.

**3.09 FINISHES**

- A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system specified in Division 09 painting Sections.
- 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.

**END OF SECTION**

**SECTION 22 05 23 - GENERAL DUTY VALVES FOR PLUMBING**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUMMARY ..... 1  
1.3 DEFINITIONS ..... 1  
1.4 SUBMITTALS ..... 1  
1.5 QUALITY ASSURANCE ..... 1  
1.6 DELIVERY, STORAGE, AND HANDLING ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 VALVES, GENERAL ..... 2  
2.2 BRONZE BALL VALVES ..... 3  
2.3 GENERAL SERVICE BUTTERFLY VALVES ..... 3  
2.4 BRONZE CHECK VALVES ..... 4  
2.5 IRON SWING CHECK VALVES ..... 4  
2.6 LIFT CHECK VALVES ..... 5  
2.7 SPRING-LOADED, CENTER-GUIDED LIFT-DISC (SILENT) CHECK VALVES ..... 5  
2.8 BRONZE GLOBE VALVES ..... 5  
2.9 DRAIN VALVES ..... 6  
2.10 SOURCE QUALITY CONTROL ..... 6  
PART 3 - EXECUTION ..... 6  
3.1 EXAMINATION ..... 6  
3.2 VALVE INSTALLATION ..... 6  
3.3 JOINT CONSTRUCTION ..... 6  
3.4 ADJUSTING ..... 6

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical Identification" for valve tags and charts.
  - 2. Division 22 piping Sections for specialty valves applicable to those Sections only.

**1.02 SUMMARY**

- A. This Section includes valves for general plumbing applications. Refer to piping Sections for specialty valve applications.

**1.03 DEFINITIONS**

- A. The following are standard abbreviations for valves:
  - 1. CWP: Cold working pressure.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.
  - 4. NRS: Nonrising stem.
  - 5. OS&Y: Outside screw and yoke.
  - 6. PTFE: Polytetrafluoroethylene plastic.
  - 7. RPTFE: Reinforced polytetrafluoroethylene plastic.
  - 8. SWP: Steam working pressure.
  - 9. TFE: Tetrafluoroethylene plastic.
  - 10. WOG: Water, oil, and gas.

**1.04 SUBMITTALS**

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
  - 1. Certification that products for use in potable water systems comply with NSF 61 and NSF 372.

**1.05 QUALITY ASSURANCE**

- A. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

### **PART 2 PRODUCTS**

#### **2.01 VALVES, GENERAL**

- A. Isolation valves are scheduled on the Drawings. For other general plumbing valve applications, use the following:
  - 1. Throttling Service: Angle, ball, butterfly, or globe valves.
  - 2. Pump Discharge: Spring-loaded, lift-disc check valves; and bronze lift check valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. 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.
- D. For valves not indicated in the Application Schedules, select valves with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for condenser water, heating hot water, steam, and steam condensate services.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged, solder-joint, or threaded ends.
  - 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.
  - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
  - 7. For Grooved-End Systems: Valve ends may be grooved.
- E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted unless otherwise noted. Wetted surfaces of valves contacted by consumable water shall contain not more than 0.25 percent weighted average lead content.
  - 1. Exceptions:
    - a. Valves in pumped sanitary systems.
    - b. Valves in pumped storm systems.
    - c. Drain valves.
    - d. Valves in general air or vacuum systems.
    - e. Valves in irrigation systems.
    - f. Valves in non-potable water systems.
    - g. Valves in other plumbing systems not intended for human consumption.
- F. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- G. Valve Actuators:
  - 1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
  - 2. Gear Drive Operator: For quarter-turn valves NPS 8 and larger.
  - 3. Handwheel: For valves other than quarter-turn types.

- 4. Lever Handle: For quarter-turn valves NPS 6 and smaller.
- H. Extended Valve Stems: On insulated valves.
- I. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- J. Valve Grooved Ends: AWWA C606.
- K. Solder Joint: With sockets according to ASME B16.18.
  - 1. Caution: Disassemble valves when soldering, as recommended by the manufacturer, to prevent damage to internal parts.
- L. Threaded: With threads according to ASME B1.20.1.
- M. Valve Bypass and Drain Connections: MSS SP-45.

## 2.02 BRONZE BALL VALVES

- A. Bronze Ball Valves, General: MSS SP-110 and have bronze body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder ends, and blowout-proof stems.
- B. Two-Piece, Regular Port Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; and 150 psig SWP and 600-psig CWP ratings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 70LF-140/240.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company; Model UPBA100S/150S.
    - d. NIBCO INC.; Models S-580-70-66-LF/T-580-70-66-LF.
    - e. Watts Water Technologies, Inc.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel ball and stem, reinforced TFE seats, blow-out-proof stem, with adjustable stem packing, soldered or threaded ends; 150 psig SWP and 600-psig CWP ratings.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 77CLF-140/240.
    - b. Hammond Valve.
    - c. Milwaukee Valve Company; UPBA400S/450S.
    - d. NIBCO INC.; Models S-585-70-66-LF/T-585-70-66-LF.
    - e. Watts Water Technologies, Inc.

## 2.03 GENERAL SERVICE BUTTERFLY VALVES

- A. General: MSS SP-67, for bubble-tight shutoff, extended-neck for insulation, disc and lining suitable for potable water, unless otherwise indicated, and with the following features:
  - 1. Full lug, and grooved valves shall be suitable for bi-directional dead end service at full rated pressure without the use or need of a downstream flange.
  - 2. Valve sizes NPS 2 through NPS 6 shall have lever lock operator; valve sizes NPS 8 and larger shall have weatherproof gear operator.
- B. Lug-Style (Single-Flange) Size NPS 2-1/2 through NPS 12, 200-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, Type 416 stainless-steel stem, copper bushing, aluminum-bronze disc, and molded-in EPDM seat (liner).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 143 and Series LD145.
    - b. Bray International, Inc.
    - c. DeZurik.
    - d. Forum Energy Technologies; ABZ Valve.
    - e. Hammond Valve.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.; LD-2000-3/5.
    - h. Pentair Valves & Controls; Keystone.
    - i. Tyco Flow Control; Grinnell Flow Control.
    - j. Watts Water Technologies.

- C. Lug-Style (Single-Flange) Size NPS 14 and Larger, 150-psig CWP Rating, Aluminum-Bronze Disc, EPDM Seat, Ferrous-Alloy Butterfly Valves: Full-lug type with ductile-iron body, one- or two-piece Type 416 stainless-steel stem, bronze bushing, and phenolic-backed EPDM seat (liner) attached to the body.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Series 143 and Series LD145.
    - b. Bray International, Inc.
    - c. DeZurik.
    - d. Forum Energy Technologies; ABZ Valve.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.; LD-1000-5.
    - g. Pentair Valves & Controls; Keystone.
    - h. Tyco Flow Control; Grinnell Flow Control.
    - i. Watts Water Technologies.
- D. Grooved-End Butterfly Valves with EPDM-Encapsulated Ductile-Iron Disc: Ductile-iron body with grooved or shouldered ends and polyamide coating inside and outside; Type 416 stainless-steel stem, PTFE bronze sintered on steel bushing, and 300-psig CWP Rating for Valves NPS 2 through NPS 8, 200 psig CWP Rating for Valves NPS 10 through NPS 12.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. NIBCO INC.; Model GD-4765-3/5.
    - c. Tyco Fire & Building Products; Grinnell Mechanical Products.
    - d. Victaulic Co. of America.

#### **2.04 BRONZE CHECK VALVES**

- A. Bronze Check Valves, General: MSS SP-80.
- B. Class 125, Bronze, Swing Check Valves with Bronze Disc: ASTM B-62 bronze body and seat with regrinding-type bronze disc, Y-pattern design, soldered or threaded end connections, and having 200 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Model 162T-LF and 163T-LF (61YLF Series).
    - b. Milwaukee Valve Company; Model UP509/UP1509.
    - c. NIBCO INC.; Models S-413-B-LF or T-413-B-LF.
    - d. Watts Water Technologies; LFCVY/LFCVYS.

#### **2.05 IRON SWING CHECK VALVES**

- A. Iron Swing Check Valves, General: MSS SP-71.
- B. Class 125, Gray-Iron, Standard Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; bronze disc and seat; and having 200 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Model 910F.
    - b. Crane Co.; Crane Valves.
    - c. Crane Co.; Stockham Div.
    - d. Hammond Valve; IR1124-HI.
    - e. Milwaukee Valve Company; Model F-2974.
    - f. NIBCO INC.; Model F-918-B.
    - g. Watts Water Technologies.
- C. Class 250, Gray-Iron, Swing Check Valves: ASTM A-126, Class B cast-iron body and bolted bonnet with flanged end connections; non-asbestos synthetic-fiber gaskets; and bronze disc and seat; and having 500 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Model 920F.
    - b. Crane Co.; Crane Valves.
    - c. Crane Co.; Stockham Div.
    - d. Hammond Valve; IR322.
    - e. Milwaukee Valve Company; Model F-2970.
    - f. NIBCO INC.; Model F-968-B.
    - g. Watts Water Technologies.

- D. Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends; nonasbestos, synthetic-fiber gaskets; rubber seats; and having 250-psig CWP Rating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mueller Co.
    - b. NIBCO, INC.; Model G-917-W.
    - c. Tyco Fire & Building Products; Grinnell Mechanical Products.
    - d. Victaulic Co. of America.

## 2.06 LIFT CHECK VALVES

- A. Class 125, Lift Check Valves with Nonmetallic TFE Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Model CBV-LF (61LF Series).
    - b. Hammond Valve; UP943 and UP947.
    - c. Milwaukee Valve Company; UP548T and UP1548T.
    - d. NIBCO INC.; Model S-480-Y-LF and T-480-Y-LF.
    - e. Watts Water Technologies; LF600.
  2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 250 psig.
    - c. Body Design: Vertical flow.
    - d. Body Material: Lead free brass or bronze.
    - e. Ends: Threaded or Solder.
    - f. Disc: PTFE, or TFE.

## 2.07 SPRING-LOADED, CENTER-GUIDED LIFT-DISC (SILENT) CHECK VALVES

- A. Lift-Disc Check Valves, General: FCI 74-1 and MIL-V-18436F, with spring-loaded, center-guided bronze disc and seat.
- B. Class 125, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 200 psig CWP rating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model W-910-B-LF.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.
- C. Class 250, Wafer, Lift-Disc Check Valves: Wafer style with cast-iron body with diameter made to fit within bolt circle, and having 400 psig CWP rating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model W-960-B-LF.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.
- D. Class 125, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 200 psig CWP rating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model F-910-B-LF.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.
- E. Class 250, Globe, Flanged Lift-Disc Check Valves: Globe style with cast-iron body and flanged ends, and having 400 psig CWP rating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.; Model F-960-B-LF.
    - b. Mueller Steam Specialty.
    - c. Milwaukee Valve Company.
    - d. Hammond Valve.

## 2.08 BRONZE GLOBE VALVES

- A. Bronze Globe Valves, General: MSS SP-80, with malleable-iron handwheel.

- B. Class 125, TFE Disc, Bronze Globe Valves: ASTM B-62 bronze body, bonnet, and seat, TFE disc, copper-silicone bronze stem, union-ring bonnet, soldered or threaded end connections; and having 200 psig CWP rating.
  - 1. Manufacturers: Subject to compliance with requirements, Provide products by one of the following:
    - a. Apollo Valves; by Conbraco Industries, Inc.; Model 121T-LF.
    - b. Hammond Valve; UP418 and UP440.
    - c. Milwaukee Valve Company; Model UP502 and UP1502.
    - d. Watts Water Technologies, Inc.; LFGLV.

## **2.09 DRAIN VALVES**

- A. Ball-Valve-Type, Hose-End Drain Valves:
  - 1. Bronze ball valve as specified in this Section. Lead free construction is not required.
  - 2. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## **2.10 SOURCE QUALITY CONTROL**

- A. Identification: Factory label or identify lead free valves.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### **3.02 VALVE INSTALLATION**

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe. Butterfly valves shall be installed with stem horizontal to allow support for the disc and the cleaning action of the disc.
- E. Install valves in position to allow full stem movement.
- F. Install chainwheel operators on valves NPS 4 and larger and more than 84 inches above floor. Extend chains to 60 inches above finished floor elevation.
- G. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  - 3. Lift Check Valves: With stem upright and plumb.

### **3.03 JOINT CONSTRUCTION**

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

### **3.04 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

**END OF SECTION**



This page intentionally left blank

**SECTION 22 11 16 - DOMESTIC WATER PIPING**

PART 1 - GENERAL ..... 1

1.1 RELATED DOCUMENTS ..... 1

1.2 SUMMARY ..... 1

1.3 PERFORMANCE REQUIREMENTS ..... 1

1.4 SYSTEMS DESCRIPTION ..... 1

1.5 SUBMITTALS ..... 2

1.6 QUALITY ASSURANCE ..... 2

1.7 PROJECT CONDITIONS ..... 2

1.8 COORDINATION ..... 2

PART 2 - PRODUCTS ..... 2

2.1 MANUFACTURERS ..... 2

2.2 PIPING MATERIALS ..... 2

2.3 COPPER TUBE AND FITTINGS ..... 2

2.4 VALVES ..... 3

2.5 WATER METERS ..... 3

PART 3 - EXECUTION ..... 3

3.1 EXCAVATION ..... 3

3.2 PIPING SYSTEM INSTALLATION ..... 3

3.3 JOINT CONSTRUCTION ..... 3

3.4 WATER METER INSTALLATION ..... 4

3.5 HANGER AND SUPPORT INSTALLATION ..... 4

3.6 CONNECTIONS ..... 4

3.7 FIELD QUALITY CONTROL ..... 5

3.8 ADJUSTING ..... 5

3.9 CLEANING AND DISINFECTION ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods" for materials and methods common to mechanical piping systems.
  - 3. Division 20 Section "Hangers and Supports."
  - 4. Division 20 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
  - 5. Division 22 Section "Plumbing Valves" for general duty plumbing valves.
  - 6. Division 22 Section "Domestic Water Piping Specialties" for water distribution piping specialties.

**1.02 SUMMARY**

- A. This Section includes domestic water piping and water meters inside the building.
- B. Water meters will be furnished by utility company for installation by Contractor.

**1.03 PERFORMANCE REQUIREMENTS**

- A. Where not indicated on the Drawings, provide components and installation capable of producing domestic water piping systems with 125 psig, unless otherwise indicated.

**1.04 SYSTEMS DESCRIPTION**

- A. Potable and non-potable domestic water piping system materials are scheduled on the Drawing.
- B. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 22 Section "Facility Water Distribution."
- C. Refer to Application Schedules on the Drawings for valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
  - 2. Drain Duty: Hose-end drain valves.
  - 3. Isolation Valves at Domestic Water Meters: Gate Valves, NPS 2 and Smaller: Class 150, bronze.
  - 4. Isolation Valves at Domestic Water Meters: Gate Valves, NPS 2-1/2 and Larger: Class 125, OS&Y, bronze-mounted cast iron.

- D. Transition and special fittings with pressure ratings at least equal to piping rating may be used unless otherwise indicated.

#### **1.05 SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings and water meters.
- B. Field quality-control test reports.

#### **1.06 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

#### **1.07 PROJECT CONDITIONS**

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service without Owner's written permission.

#### **1.08 COORDINATION**

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

### **PART 2 PRODUCTS**

#### **2.01 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.

#### **2.02 PIPING MATERIALS**

- A. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

#### **2.03 COPPER TUBE AND FITTINGS**

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- B. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- C. Grooved-Joint Systems:
  - 1. Manufacturers:
    - a. Anvil International, Inc.; Gruvlok Manufacturing; Model 7401.
    - b. Tyco Fire & Building Products; Grinnell Mechanical Products; Model 672.
    - c. Victaulic Company; Style 606 and Style 607.

2. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
  3. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
- D. Copper or Bronze Pressure-Seal Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Viega North America; ProPress System.
    - b. NIBCO Inc.; Press System.
    - c. Elkhart Products Corporation; an Aalberts Industries Company; Xpress.
    - d. Apollo Valves; by Conbraco Industries; ApolloXpress.
  2. Housing: Copper.
  3. O-Rings and Pipe Stops: EPDM.
  4. Tools: Manufacturer's special tools.
  5. Maximum 200-psig working-pressure rating at 250 deg F.
- E. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube. Mechanically formed tee fittings may be used up to half size of main.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. T-DRILL Industries Inc.

#### **2.04 VALVES**

- A. General-duty plumbing valves; and drain valves are specified in Division 22 Section "Plumbing Valves."
- B. Balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."

#### **2.05 WATER METERS**

- A. Refer to Division 20 Section "Mechanical General Requirements."

### **PART 3 EXECUTION**

#### **3.01 EXCAVATION**

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

#### **3.02 PIPING SYSTEM INSTALLATION**

- A. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Install under-building-slab copper tubing according to Copper Development Association's "Copper Tube Handbook." Joints under slab are not allowed. Install PVC sleeve where piping penetrates slab.
- C. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 20 Section "Meters and Gages," and strainers are specified in Division 22 Section "Domestic Water Piping Specialties."
- E. 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.
- F. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  1. Install hose-end drain valves at low points in water mains, risers, and branches.
  2. Install stop-and-waste drain valves where indicated.
- G. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 22 Section "Domestic Water Piping Specialties."
- H. Install domestic water piping level without pitch and plumb.

#### **3.03 JOINT CONSTRUCTION**

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."

### 3.04 WATER METER INSTALLATION

- A. Rough-in domestic water piping for water meter installation and install water meters according to utility company's requirements.
- B. Water meters will be furnished by utility company.
- C. Install water meters according to AWWA M6 and utility's requirements.
  - 1. Install displacement-type water meters with shutoff valve on water-meter inlet. Install valve on water-meter outlet and valved bypass around meter unless prohibited by authorities having jurisdiction.

### 3.05 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 20 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet 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: MSS Type 49, spring cushion rolls, if indicated.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. 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.
- F. Install supports for vertical steel piping every 15 feet.
- G. Install hangers for drawn-temper 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.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Soft copper tube: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- J. Alternate support for copper tubing NPS 3/4 and smaller: Continuous support using v-shaped plastic pipe channel, maximum hanger spacing 8 feet with 3/8-inch rod.
- K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic water piping to distribution side of water meter with shutoff valve.
- C. Connect domestic water piping to existing domestic water distribution piping. Use dielectric fitting if connection dissimilar metals. Refer to Application Schedule on the Drawings and Division 20 Section "Basic Mechanical Materials and Methods" for dielectric fittings.
- D. Install piping adjacent to equipment and machines to allow service and maintenance.
- E. Connect domestic water piping to the following:

1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### **3.07 FIELD QUALITY CONTROL**

- A. Inspect domestic water piping as follows:
  1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  3. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
  4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:
  1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  4. Cap and subject piping to static water pressure of 150 psig. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.

### **3.08 ADJUSTING**

- A. Perform the following adjustments before operation:
  1. Close drain valves, hydrants, and hose bibbs.
  2. Open shutoff valves to fully open position.
  3. Open throttling valves to proper setting.
  4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
  6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.09 CLEANING AND DISINFECTION**

- A. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

- B. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm 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.
- C. Prepare and submit reports of purging and disinfecting activities.

**END OF SECTION**

**SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 PERFORMANCE REQUIREMENTS ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
PART 2 - PRODUCTS ..... 2  
2.1 BACKFLOW PREVENTERS ..... 2  
2.2 BALANCING VALVES ..... 2  
2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES ..... 2  
2.4 PREPIPED TEMPERED WATER MIXING SYSTEM (MV-1) ..... 3  
2.5 STRAINERS FOR DOMESTIC WATER PIPING ..... 3  
2.6 OUTLET BOXES ..... 3  
2.7 WALL HYDRANTS ..... 4  
2.8 YARD VALVE BOX ..... 4  
2.9 WATER HAMMER ARRESTERS ..... 4  
2.10 DOMESTIC WATER CARTRIDGE FILTERS ..... 4  
2.11 AIR VENTS ..... 5  
PART 3 - EXECUTION ..... 5  
3.1 INSTALLATION ..... 5  
3.2 DOMESTIC WATER CARTRIDGE-FILTER INSTALLATION ..... 6  
3.3 CONNECTIONS ..... 6  
3.4 LABELING AND IDENTIFYING ..... 6  
3.5 FIELD QUALITY CONTROL ..... 6  
3.6 ADJUSTING ..... 6

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 20 Section "Meters and Gages" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 4. Division 22 Section "Domestic Water Piping" for water meters.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Flow Reports and Settings: For calibrated balancing valves.
- E. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

**1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- C. 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."



3. Comply with NSF 372, "Drinking Water System Components – Lead Content" for components with wetted surfaces in contact with potable water.

## **PART 2 PRODUCTS**

### **2.01 BACKFLOW PREVENTERS**

- A. Ice Maker Equipment Backflow Preventers:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. Watts Water Technologies, Inc.; Watts Regulator Co.
    - c. Zurn Plumbing Products Group; Wilkins Div.
  2. Standard: ASSE 1022.
  3. Operation: Continuous-pressure applications.
  4. Size: NPS 1/4 or NPS 3/8.
  5. Body: Stainless steel or Acetal plastic.
  6. End Connections: Threaded.
- B. Reduced-Pressure-Principle Backflow Preventers:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. FEBCO; a Division of Watts Water Technologies, Inc.
    - c. Watts Water Technologies, Inc.; Ames Fire & Waterworks.
    - d. Watts Water Technologies, Inc.; Watts Regulator Co.
    - e. Zurn Plumbing Products Group; Wilkins Div.
  2. Standard: ASSE 1013.
  3. Operation: Continuous-pressure applications.
  4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
  5. Size and Capacities: As scheduled on the drawings.
  6. Body: Bronze for NPS 2 and smaller; cast-iron or ductile-iron, with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
  7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  8. Configuration: Designed for horizontal, straight through flow.
  9. Accessories:
    - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; 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.

### **2.02 BALANCING VALVES**

- A. Calibrated Balancing Valves NPS 1/2:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Armstrong International, Inc.
    - b. Armstrong Pumps, Inc.
    - c. Apollo Valves; by Conbraco Industries, Inc.
    - d. Bell & Gossett; Xylem Inc.
    - e. Flo Fab Inc.
    - f. Flow Design Inc.
    - g. Griswold Controls.
    - h. NIBCO INC.
    - i. IMI Indoor Climate; Tour & Andersson.
    - j. Taco, Inc.
    - k. Watts Water Technologies, Inc.; Watts Regulator Co.
  2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
  3. Body: Dezincification resistant brass, or bronze.
  4. Minimum Flow Rate: 0.3 gpm.

### **2.03 TEMPERATURE-ACTUATED WATER MIXING VALVES**

- A. Water-Temperature Limiting Devices, refer to plumbing fixture schedule on plans.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. Bradley Corporation.
    - c. Lawler Manufacturing Company, Inc.

- d. Leonard Valve Company.
- e. Watts Water Technologies, Inc.; Powers Division; Hydroguard Series.
- f. Watts Water Technologies, Inc.; Watts Regulator Co.
- g. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1070.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: 1/2-inch union or 3/8-inch compression; with integral check valves.
7. Accessories: Adjustable temperature-control knob.
8. Outlet Temperature Range: Adjustable from 85 deg F to 120 deg F. Set at 105 deg F.
9. Minimum Flow Rate: 0.5 gpm.
10. Valve Finish: Rough bronze.

#### **2.04 PREPIPED TEMPERED WATER MIXING SYSTEM (MV-1)**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Controls; Morris Group International.
  - b. Armstrong International, Inc. (RADA).
  - c. Bradley Corporation.
  - d. Lawler Manufacturing Company, Inc.; Prepiped 802 Hi-Low Tempered water Mixing System.
  - e. Leonard Valve Company.
  - f. Symmons Industries, Inc.
  - g. Watts Water Technologies, Inc.; Powers Division.
  - h. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Description: Completely assembled and tested prepiped manifold system including mixing valve(s), recirculation pump, circuit setting balancing valve, aquastat, circulator switch box, thermometers, isolation valves, mounting strut, and test connection.
3. Standard: ASSE 1017.
4. Mixing Valve: Exposed-mounting, thermostatically controlled water mixing valve.
  - a. Material: Bronze body with corrosion-resistant interior components.
  - b. Connections: Threaded union inlets and outlet.
  - c. Accessories: Manual temperature control, check stops and strainers on hot- and cold-water supplies, and adjustable, temperature-control handle.
  - d. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
  - e. Size, Settings, and Capacities: As scheduled on the drawings.
  - f. Valve Finish: Rough bronze.
5. Pump: Meeting requirements in Division 22 Section "Domestic Water Circulation Pumps."
6. Mounting Strut: Meeting requirements in Division 20 Section "Hangers and Supports."

#### **2.05 STRAINERS FOR DOMESTIC WATER PIPING**

- A. Y-Pattern Strainers:
  1. Manufacturers:
    - a. Apollo Valves; Conbraco Industries, Inc.
    - b. Keckley.
    - c. Metraflex.
    - d. Mueller Steam Specialty.
    - e. NIBCO, Inc.
    - f. Spence.
    - g. SSI Equipment, Inc.
    - h. Watts Water Technologies, Inc.
    - i. Yarway.
  2. CWP: 200 psig minimum, unless otherwise indicated.
  3. SWP: 125 psig minimum, unless otherwise indicated.
  4. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
  5. End Connections: Threaded or soldered for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  6. Screen: Stainless steel with round perforations, unless otherwise indicated.

#### **2.06 OUTLET BOXES**

- A. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Sioux Chief Manufacturing Company, Inc.; Ox Box.
  - b. Oatey SCS.
  - c. LSP Products Group, Inc.
  - d. Acorn Engineering Company.
2. Mounting: Recessed.
3. Material and Finish: Enameled- or epoxy-painted-steel or Stainless-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

## 2.07 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Water Technologies, Inc.; Watts Regulator co.
  - f. Woodford Manufacturing Company.
  - g. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze or chrome plated.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): One with each wall hydrant.

## 2.08 YARD VALVE BOX

### A. Domestic Water Yard Valve Box:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Tyler Union; Series 6860, heavy-duty type.
  - b. Approved equal.
2. Description: Pre-assembled, cast-iron, three-piece valve box. 4 inch pipe size, Shaft length tp accommodate a valve depth of 72 inches below grade.
3. Standards: Class 35 cast iron, ASME A-48 listed.
4. Pressure Rating: minimum 125 psig
5. Operation: Wrench key. Provide two (2) wrench keys.

## 2.09 WATER HAMMER ARRESTERS

### A. Water Hammer Arresters (Copper Tube Type):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc.
  - b. PPP Inc.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Watts Water Technologies, Inc.; Watts Regulator Co.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.10 DOMESTIC WATER CARTRIDGE FILTERS

### A. Off-Floor Cartridge Filters:

1. Manufacturers:

- a. Culligan International Company.
  - b. Harmsco Filtration Products.
  - c. Osmonics, Inc.; Hytrex Filters Div.
  - d. Parker Hannifin Corporation; Process Filtration Div.
  - e. Water Equipment Technologies (WET); Xylem Inc.
  - f. Watts Premier.
2. Description: Simplex, wall-mounting housing with replaceable element for removing suspended particles from water.
    - a. Housing: Corrosion resistant; designed to separate feedwater from filtrate and to direct feedwater through water filter element; with element support.
      - 1) Pipe Connections: Threaded according to ASME B1.20.1.
      - 2) Support: Wall bracket.
    - b. Element: Replaceable; of shape to fit housing.
  3. Capacity and Characteristics:
    - a. Refer to Schedule on Drawings.

## 2.11 AIR VENTS

- A. Bolted-Construction Automatic Air Vents:
  1. Body: Bronze.
  2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
  3. Float: Replaceable, corrosion-resistant metal.
  4. Mechanism and Seat: Stainless steel.
  5. Size: NPS 3/8 minimum inlet.
  6. Inlet and Vent Outlet End Connections: Threaded.
- B. Welded-Construction Automatic Air Vents:
  1. Body: Stainless steel.
  2. Pressure Rating: 150-psig minimum pressure rating.
  3. Float: Replaceable, corrosion-resistant metal.
  4. Mechanism and Seat: Stainless steel.
  5. Size: NPS 3/8 minimum inlet.
  6. Inlet and Vent Outlet End Connections: Threaded.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
  4. Install strainer and soft-seated check valve upstream of backflow preventer. Exception: Fire protection backflow preventers.
- C. Install balancing valves in locations where they can easily be adjusted.
- D. Install temperature-actuated water mixing valves with strainers, and 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 backflow preventer.
- F. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- G. Install water hammer arresters in water piping according to PDI-WH 201.

- H. Install air vents at high points of water piping.

### **3.02 DOMESTIC WATER CARTRIDGE-FILTER INSTALLATION**

- A. Install cartridge filters 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.
- B. Attach wall brackets for off-floor, wall-mounting, cartridge filter to vertical surface. Attach housing(s), and base if any, to wall bracket.
- C. Install housings for off-floor, in-line, cartridge filters in piping.
- D. Install isolation valves on inlet and outlet piping of each water filter.
- E. Install pressure gages on inlet and outlet piping of each water filter. Pressure gages are specified in Division 20 Section "Meters and Gages."
- F. Install filter elements in cartridges after completion of flushing and cleaning.

### **3.03 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping and specialties.

### **3.04 LABELING AND IDENTIFYING**

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Reduced-pressure-principle backflow preventers.
  - 2. Ice maker backflow preventers.
  - 3. Calibrated balancing valves.
  - 4. Primary, thermostatic, water mixing valves.
  - 5. Outlet boxes.
- 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 20 Section "Mechanical Identification."

### **3.05 FIELD QUALITY CONTROL**

- A. Perform the following tests and prepare test reports:
  - 1. Test each pressure vacuum breaker, 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.

### **3.06 ADJUSTING**

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves as follows:
  - 1. Set calibrated balancing valves at calculated pre-settings.
  - 2. Measure flow at each station and adjust where necessary.
  - 3. Record settings and mark balancing devices.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

**END OF SECTION**

**SECTION 22 11 23 - DOMESTIC WATER CIRCULATION PUMPS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUBMITTALS ..... 1  
1.3 QUALITY ASSURANCE ..... 1  
1.4 DELIVERY, STORAGE, AND HANDLING ..... 1  
PART 2 - PRODUCTS ..... 1  
2.1 MANUFACTURERS ..... 1  
2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS (SMALL)..... 2  
2.3 CONTROLS ..... 2  
2.4 FLEXIBLE CONNECTORS ..... 2  
PART 3 - EXECUTION ..... 2  
3.1 EXAMINATION ..... 2  
3.2 PUMP INSTALLATION ..... 2  
3.3 CONTROL INSTALLATION ..... 2  
3.4 CONNECTIONS ..... 2  
3.5 STARTUP SERVICE ..... 3  
3.6 DEMONSTRATION ..... 3

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 SUBMITTALS**

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and Maintenance Data: For domestic water pumps to include in emergency, operation, and maintenance manuals.

**1.03 QUALITY ASSURANCE**

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of domestic water pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- E. UL Compliance: Comply with UL 778 for motor-operated water pumps.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

**PART 2 PRODUCTS**

**2.01 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.

## **2.02 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS (SMALL)**

- A. Manufacturers:
  1. Armstrong Pumps Inc.
  2. Bell & Gossett; Xylem Inc.; Series PL.
  3. Grundfos Pumps Corp.
  4. Taco, Inc.; Series 1400.
- B. Description: Factory-assembled and –tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; and designed for installation with pump and motor shafts mounted horizontally.
  1. Pump Construction: All bronze.
    - a. Casing: Radially split, bronze, with threaded companion-flange connections.
    - b. Impeller: Glass-reinforced corrosion-resistant material; keyed to shaft.
    - c. Shaft: High-strength alloy steel.
    - d. Seal: Mechanical, carbon/silicon carbide seal.
    - e. Bearings: Permanently oil-lubricated type.
  2. Motor-Single speed, with oil-lubricated bearings, unless otherwise indicated; and directly mounted to pump casing. Comply with requirements in Division 20 Section “Motors.”
- C. Capacities and Characteristics: Refer to Schedule on Drawings.

## **2.03 CONTROLS**

- A. Thermostats: Electric; adjustable for control of hot-water circulation pump.
  1. Manufacturers:
    - a. Honeywell International, Inc.
    - b. Square D.
    - c. White-Rodgers Div.; Emerson Electric Co.
  2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
  3. Range: 50 to 125 deg F.
  4. Operation of Pump: On or off.
  5. Transformer: Provide if required.
  6. Power Requirement: 120 V, ac.
  7. Settings: Start pump at 110 deg F and stop pump at 120 deg F.

## **2.04 FLEXIBLE CONNECTORS**

- A. Refer to Division 20 Section “Pipe Flexible Connectors, Expansion Fittings and Loops.”

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

### **3.02 PUMP INSTALLATION**

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping. Do not use pump motors as a support point.

### **3.03 CONTROL INSTALLATION**

- A. Install immersion-type thermostats in hot-water return piping.

### **3.04 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.

- C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 22 Section "Domestic Water Piping."
  - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
    - a. Separately coupled, in-line centrifugal pumps.
  - 2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 20 Section "Valves" for general-duty valves for domestic water piping and Division 22 Section "Domestic Water Piping Specialties" for strainers.
  - 3. Install pressure gages at suction and discharge of pumps. Install at integral pressure-gage tapings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 20 Section "Meters and Gages" for pressure gages and gage connectors.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."
- F. Connect thermostats to pumps that they control.

### **3.05 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - 3. Clean strainers on suction piping.
  - 4. Set thermostats for automatic starting and stopping operation of pumps.
  - 5. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  - 6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  - 7. Start motor.
  - 8. Open discharge valve slowly.
  - 9. Adjust temperature settings on thermostats.
  - 10. Adjust timer settings.

### **3.06 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

**END OF SECTION**



This page intentionally left blank

**SECTION 22 11 24 - DOMESTIC-WATER PACKAGED BOOSTER PUMPS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUMMARY ..... 1  
1.3 DEFINITIONS ..... 1  
1.4 SUBMITTALS ..... 1  
1.5 QUALITY ASSURANCE ..... 1  
1.6 DELIVERY, STORAGE, AND HANDLING ..... 2  
1.7 COORDINATION ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 MANUFACTURERS ..... 2  
2.2 VARIABLE-SPEED, MULTIPLEX BOOSTER PUMPS ..... 2  
PART 3 - EXECUTION ..... 4  
3.1 EXAMINATION ..... 4  
3.2 CONCRETE BASES ..... 4  
3.3 BOOSTER PUMP INSTALLATION ..... 4  
3.4 CONNECTIONS ..... 4  
3.5 STARTUP SERVICE ..... 4  
3.6 LABELING AND IDENTIFICATION ..... 5  
3.7 DEMONSTRATION ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Domestic Water Pumps" for domestic water circulation pumps.

**1.02 SUMMARY**

- A. This Section includes variable-speed, multiplex, packaged booster pumps for domestic water systems.

**1.03 DEFINITIONS**

- A. EEPROM: Electrically erasable programmable read-only memory.
- B. PID: Proportional plus integral plus derivative.

**1.04 SUBMITTALS**

- A. Product Data: For each packaged booster pump specified include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: For packaged booster pumps and accessories. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails and equipment mounting frames.
  - 3. Wiring Diagrams: Detail power, signal, and control wiring.
- C. Operation and Maintenance Data: For each packaged booster pump to include in operation and maintenance manuals.

**1.05 QUALITY ASSURANCE**

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged booster pumps and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

- C. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- D. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- E. ASME Compliance: Comply with ASME B31.9 for piping.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written rigging instructions for handling.

#### **1.07 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.

### **PART 2 PRODUCTS**

#### **2.01 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.

#### **2.02 VARIABLE-SPEED, MULTIPLEX BOOSTER PUMPS**

- A. Description: Factory-assembled and -tested, packaged booster pump with multiple pumps, piping, valves, sensors, variable frequency drive, and controls on skids or base.
- B. System Working-Pressure Rating: 150 psig (1035 kPa) minimum.
- C. Pump Arrangement: Duplex, with two equal-size pumps sized as scheduled on the Drawings.
- D. Pumps: Overhung impeller, close coupled, single stage, end suction, centrifugal. Comply with UL 778 and Hydraulic Institute HI 1.1-1.2 and HI 1.3.
  - 1. Manufacturers:
    - a. Armstrong Pumps, Inc.
    - b. Aurora Pump; Pentair Pump Group (The).
    - c. Bell & Gossett; Xylem Inc.
    - d. Canariis Corporation.
    - e. Metropolitan Industries, Inc.
    - f. Peerless Pump Company.
    - g. QuantumFlo, Inc.
    - h. SynchroFlo, Inc.
  - 2. Each Pump:
    - a. Orientation: Mounted horizontally.
    - b. Construction: Bronze fitted.
      - 1) Casing: Radially split, cast iron.
      - 2) Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, closed, and keyed to shaft.
      - 3) Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.
      - 4) Seal: Mechanical.
- E. Motors: Select motor that will not overload through full range of pump performance curve. Comply with Division 20 Section "Motors."
- F. Relief Valves: Adjustable, pressure relief type on pump discharge.
- G. Piping: ASME B31.9 for piping materials and installation.
  - 1. NPS 4 and Smaller: ASTM B 88, Type L (ASTM B 88M, Type B), drawn copper water tube; with copper solder-joint pressure fittings, and brazed joints or ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded, cast-iron fittings and threaded joints.
  - 2. NPS 5 and Larger: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded, cast-iron fittings and threaded joints.

3. Header End Connections:
  - a. NPS 2 and Smaller: Threaded.
  - b. NPS 2-1/2 and Larger: Flanged.
4. Piping Option: Piping, including valves and other components, may have grooved ends for grooved joints.
- H. Valves: Include shutoff valve at each pump suction, and shutoff valve and check valve at each pump discharge.
  1. Shutoff Valves, NPS 2 and Smaller: MSS SP-80, Class 125, bronze rising-stem gate valve or MSS SP-110, 600-psig minimum CWP, bronze ball valve with ends matching piping.
  2. Shutoff Valves, NPS 2-1/2 (DN 65) and Larger: MSS SP-70, Class 125, bronze-trim, OS&Y, cast-iron gate valve with flanged ends or MSS SP-67, Type I for tight shutoff, 175-psig CWP, single-flanged, cast-iron butterfly valve.
  3. Check Valves, NPS 2 and Smaller: Spring- or lever-loaded, MSS SP-80, Class 125, bronze, swing check valve.
  4. Check Valves, NPS 2-1/2 and Larger: Spring- or lever-loaded, MSS SP-71, Class 125, bronze-trim, cast-iron, swing check valve.
- I. Sensors: Pressure and flow switches.
- J. Dielectric Fittings: With insulating material isolating joined dissimilar metals to prevent galvanic action and to stop corrosion.
  1. NPS 2 and Smaller: Factory-fabricated union assembly, for 250-psig minimum working pressure at 180 deg F.
  2. NPS 2-1/2 and Larger: Factory-fabricated, companion-flange assembly; for 150- or 300-psig minimum working pressure as required to suit system pressures.
- K. Variable Frequency Drives:
  1. Provide and mount on the system skid variable frequency drives suitable for variable torque applications using any standard NEMA Design B squirrel cage induction motor.
  2. Variable frequency drives: Sized for maximum possible amp draw throughout the programmed sequence of pump operation.
  3. Refer to Division 20 Section "Variable Frequency Controllers" for additional requirements.
- L. Control Panel: Factory installed and connected as an integral part of unit complying with NEMA ICS 2 and UL 508; automatic for multiple-pump, variable-speed operation, with load control and protection functions.
  1. Field Power Interface: Wire lugs. Minimum SCCR according to UL 508 shall be as required by electrical power distribution system, but not less than 22,000 A.
  2. Enclosures: NEMA 250, Type 2.
  3. Logic Section:
    - a. Provide, mount and wire on the skid a programmable logic controller to interface the signal from the pressure sensor to the VFC's and provide a stabilized response to speed up or slow down pump(s) or add the lag pump(s) to meet system requirements.
    - b. Controller shall provide setpoint adjustment, timer adjustment, PID functions and both system and controller self diagnostics via touch screen display.
    - c. User interface setpoints accessible via password protected display screen.
    - d. Normal system operation tuned to eliminate hunting.
    - e. Controller shall have one RS 485 communication port, real time calendar/clock and EEPROM memory transfer cartridge.
  4. Power Section:
    - a. UL listed enclosed industrial control panel, factory mounted and wired on the steel skid.
    - b. Panel shall be furnished with individual pump disconnects with lockout handles and having SCCR to match main disconnecting means, pump run lights, H-O-A selector switches and 115 volt fused control transformer.
  5. Instrumentation: Unit suction and discharge pressure gages.
  6. Alarm Signal Device: Sounds alarm when backup pumps are operating.
  7. High-suction pressure cutout.
  8. High-discharge pressure cutout.
  9. Remote signal contacts.
- M. Sequence of Operation:
  1. Lead pump shall run continuously to maintain system pressure and will be controlled automatically by means of a pressure sensor/transmitter and programmable logic controller.

2. If lead pump is unable to maintain system pressure, lag pump(s) will be called on after a time delay and will operate in parallel with the lead pump in accordance with the PLC program.
  3. When one pump can handle the system demand the controls will shut down the lag pump(s).
  4. Pump alternation is accomplished with a 24-hour time clock.
- N. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembling and testing. Protect flanges, pipe openings, and pump nozzles.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine roughing-in for packaged booster pumps to verify actual locations of connections before booster pump installation.

#### **3.02 CONCRETE BASES**

- A. Install concrete bases of dimensions indicated for packaged booster pumps. Refer to Division 20 Section "Basic Mechanical Materials and Methods."
- B. Cast-in-place concrete materials and placement requirements are specified in Division 03.

#### **3.03 BOOSTER PUMP INSTALLATION**

- A. Install packaged booster pumps level on concrete bases with access for periodic maintenance including removal of pumps, motors, impellers, couplings, and accessories.
1. Do not dismantle packaged booster pumps or remove individual components.
- B. Vibration Isolation: Install on spring isolators with minimum deflection as scheduled on the drawings.
- C. Support connected domestic water piping so weight of piping is not supported by packaged booster pumps.

#### **3.04 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect domestic water piping to packaged booster pumps. Install suction and discharge pipe equal to or greater than size of unit suction and discharge piping.
1. Install flexible connectors on piping connections to unit suction and discharge piping. Install flexible connectors same size as piping.
  2. Install shutoff valves on piping connections to each booster pump suction and discharge piping. Install ball, butterfly, or gate valves same size as suction and discharge piping. General-duty valves are specified in Division 20 Section "Valves."
  3. Install union or flanged connections on pump suction and discharge piping at connection to domestic water piping.
  4. Install piping adjacent to packaged booster pumps to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

#### **3.05 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform the following startup service:
1. Complete installation and startup checks according to manufacturer's written instructions.
  2. Check piping connections for tightness.
  3. Clean strainers if any.
  4. Verify that pump controls are correct for required application.
- B. Perform the following startup checks for each pump of packaged booster pump unit before starting:
1. Verify bearing lubrication.
  2. Prime pumps by opening suction valves and closing discharge valves, and prepare pumps for operation.
  3. Start motors.
  4. Open discharge valves slowly.
  5. Adjust settings.

- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting packaged booster pumps to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

**3.06 LABELING AND IDENTIFICATION**

- A. Install identifying equipment markers and equipment signs on booster pumps. Labeling and identification materials are specified in Division 20 Section "Mechanical Identification."

**3.07 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged booster pumps.

**END OF SECTION**

This page intentionally left blank

**SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 SYSTEMS DESCRIPTIONS ..... 1  
1.4 SUBMITTALS ..... 1  
1.5 QUALITY ASSURANCE ..... 1  
1.6 PROJECT CONDITIONS ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 MANUFACTURERS ..... 2  
2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS ..... 2  
2.3 COPPER TUBE AND FITTINGS ..... 2  
2.4 PVC PIPE AND FITTINGS ..... 2  
2.5 SPECIALTY PIPE FITTINGS ..... 2  
PART 3 - EXECUTION ..... 3  
3.1 EXCAVATION ..... 3  
3.2 PIPING SYSTEM INSTALLATION ..... 3  
3.3 JOINT CONSTRUCTION ..... 3  
3.4 SPECIALTY PIPE FITTING INSTALLATION ..... 3  
3.5 VALVE INSTALLATION ..... 3  
3.6 HANGER AND SUPPORT INSTALLATION ..... 4  
3.7 CONNECTIONS ..... 4  
3.8 IDENTIFICATION ..... 4  
3.9 FIELD QUALITY CONTROL ..... 5  
3.10 CLEANING ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements".
  - 2. Division 20 Section "Basic Mechanical Materials and Methods".
  - 3. Division 22 Section "Drainage Piping Specialties".

**1.02 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. NBR: Acrylonitrile-butadiene rubber.
- D. PE: Polyethylene plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. TPE: Thermoplastic elastomer.

**1.03 SYSTEMS DESCRIPTIONS**

- A. Sanitary waste and vent piping system materials are scheduled on the Drawing.

**1.04 SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

**1.05 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
- C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.



## 1.06 PROJECT CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

## PART 2 PRODUCTS

### 2.01 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.

### 2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
  - 1. Manufacturers:
    - a. ANACO-Husky.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled Ideal Clamp Products, Inc.).
    - c. Ideal Clamp Products, Inc.; a Tomkins Company.
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. Tyler Pipe.
  - 2. Standards: CISPI 310.
  - 3. Description: NSF certified for compliance with CISPI 310. Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

### 2.03 COPPER TUBE AND FITTINGS

- A. 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.
- B. Hard Copper Tube: ASTM B 88, Types L, water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  - 3. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

### 2.04 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: Schedule 40, ASTM D 2665, drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

### 2.05 SPECIALTY PIPE FITTINGS

- A. Flexible, Non-pressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - 1. Manufacturers:
    - a. Dallas Specialty & Mfg. Co.
    - b. Fernco, Inc.
    - c. Logan Clay Products Company (The).
    - d. Mission Rubber Co.
    - e. NDS, Inc.
  - 2. Sleeve Materials:
    - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

- B. Shielded Non-pressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Mission Rubber Co.
- C. Rigid, Unshielded, Non-pressure Pipe Couplings: ASTM C 1461, sleeve-type reducing- or transition-type mechanical coupling molded from ASTM C 1440, TPE material with corrosion-resistant-metal tension band and tightening mechanism on each end.
  - 1. Manufacturers:
    - a. ANACO.
- D. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 1. Manufacturers:
    - a. SIGMA Corp.

### **PART 3 EXECUTION**

#### **3.01 EXCAVATION**

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

#### **3.02 PIPING SYSTEM INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- E. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- F. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

#### **3.03 JOINT CONSTRUCTION**

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- D. PVC Non-pressure Piping Joints: Join piping according to ASTM D 2665.

#### **3.04 SPECIALTY PIPE FITTING INSTALLATION**

- A. Transition Couplings:
  - 1. Install transition couplings at joints of piping with small differences in OD's.
  - 2. In Drainage Piping: Shielded, non-pressure transition couplings.

#### **3.05 VALVE INSTALLATION**

- A. General valve installation requirements are specified in Division 20 Section "Valves."
- B. Shutoff Valves: Install shutoff valve on each sewage pump discharge.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

### 3.06 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 20 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
  - 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 5. NPS 6: 10 feet with 5/8-inch rod.
  - 6. NPS 8: 10 feet with 3/4-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.08 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 20 Section "Mechanical Identification."

### **3.09 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. Re-inspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for re-inspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
  - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 6. Prepare reports for tests and required corrective action.

### **3.10 CLEANING**

- 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.

**END OF SECTION**

**SECTION 22 13 19 - DRAINAGE PIPING SPECIALTIES**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
1.5 COORDINATION ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 CAST-IRON CLEANOUTS ..... 2  
2.2 FLOOR DRAINS ..... 3  
2.3 FLOOR SINKS ..... 4  
2.4 ROOF FLASHING ASSEMBLIES ..... 4  
2.5 TRAP SEAL PROTECTION DEVICES ..... 5  
2.6 THROUGH-PENETRATION FIRESTOP ASSEMBLIES ..... 5  
2.7 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES ..... 5  
2.8 FLASHING MATERIALS ..... 6  
2.9 GREASE INTERCEPTORS ..... 6  
PART 3 - EXECUTION ..... 6  
3.1 INSTALLATION ..... 6  
3.2 FLASHING INSTALLATION ..... 7  
3.3 LABELING AND IDENTIFYING ..... 8  
3.4 FIELD QUALITY CONTROL ..... 8  
3.5 PROTECTION ..... 8

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. FOG: Fats, oils, and greases.
- C. FRP: Fiberglass-reinforced plastic.
- D. HDPE: High-density polyethylene plastic.
- E. PE: Polyethylene plastic.
- F. PP: Polypropylene plastic.
- G. PUR: Polyurethane plastic.
- H. PVC: Polyvinyl chloride plastic.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings:
  - 1. Show fabrication and installation details for frost-resistant vent terminals.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in operation and maintenance manuals.

**1.04 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary and storm piping specialty components.

### 1.05 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.
- B. Coordinate size and location of roof penetrations.

## PART 2 PRODUCTS

### 2.01 CAST-IRON CLEANOUTS

- A. Size: Cleanouts shall be same nominal size as the pipe they serve up to 4 inches. For pipes larger than 4 inches nominal size, minimum size of cleanout shall be 4 inches.
- B. Exposed Cast-Iron Cleanouts:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.; Series 58910.
    - b. MIFAB, Inc.; C1460.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; 4510 Series.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
  - 3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 4. Closure: Countersunk or raised-head, brass or bronze plug with tapered threads.
- C. Cast-Iron Floor Cleanouts (On-Grade Interior Floor Areas):
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.; C1220-R.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4023S-F.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M.
  - 3. Type: Adjustable housing.
  - 4. Body or Ferrule: Cast iron.
  - 5. Clamping Device: Not required.
  - 6. Outlet Connection: Spigot.
  - 7. Closure: Brass, bronze, or plastic plug with tapered threads.
  - 8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
  - 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
  - 10. Frame and Cover Shape: Round.
  - 11. Top Loading Classification: Medium Duty.
  - 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- D. Cast-Iron Floor Cleanouts (Not-On-Grade Interior Floor Areas):
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.; C-1100-C-R-34.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 4333C.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 2. Standard: ASME A112.36.2M.
  - 3. Type: Adjustable housing.
  - 4. Body or Ferrule: Cast iron.
  - 5. Clamping Device: Required.

6. Outlet Connection: Spigot.
  7. Closure: Brass, bronze, or plastic plug with tapered threads.
  8. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
  9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with scoriated cover in service areas, and recessed cover to accept floor finish material in finished floor areas.
  10. Frame and Cover Shape: Round.
  11. Top Loading Classification: Medium Duty.
  12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- E. Cast-Iron Wall Cleanouts (Finished Wall Areas):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.; Model 58790-20.
    - b. MIFAB, Inc.; C1460-RD.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.36.2M. Include wall access.
  3. Body: Hub-and-spigot, cast-iron soil pipe T-branch or hubless, cast-iron soil pipe test tee as required to match connected piping.
  4. Closure: Countersunk or raised-head, drilled-and-threaded bronze or brass plug with tapered threads.
  5. Wall Access: Round, deep, chrome-plated bronze flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.02 FLOOR DRAINS

- A. Cast-Iron Floor Drains FD-1:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Sioux Chief Manufacturing Company, Inc.; Finish Line Adjustable Drainage System.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 2005Y-A.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.6.3.
  3. Pattern: Floor drain.
  4. Body Material: Gray iron.
  5. Seepage Flange: Required.
  6. Clamping Device: Required.
  7. Outlet: Bottom unless otherwise noted.
  8. Coating on Interior and Exposed Exterior Surfaces: Enamel.
  9. Top or Strainer Material: Nickel bronze.
  10. Top of Body and Strainer Finish: Nickel bronze.
  11. Top Shape: Round, with vandal proof screws.
  12. Dimensions of Top or Strainer: 7 inch diameter.
  13. Top Loading Classification: Light Duty.
  14. Inlet Fitting: Gray iron, with spigot outlet.
  15. Trap Seal Protection Device: Required.
- B. Cast-Iron Floor Drains (Showers) FD-2:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Sioux Chief Manufacturing Company, Inc.; Finish Line Adjustable Drainage System.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 2005Y-A.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Specification Drainage Operation.
  2. Standard: ASME A112.6.7.
  3. Pattern: Floor drain.

4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom unless otherwise noted.
8. Coating on Interior and Exposed Exterior Surfaces: Enamel.
9. Top or Strainer Material: Nickel bronze.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Round, with vandal proof screws.
12. Dimensions of Top or Strainer: 5 inch diameter.
13. Top Loading Classification: Light Duty.
14. Inlet Fitting: Gray iron, with spigot outlet.
15. Trap Seal Protection Device: Required.

C. Cast-Iron Floor Drains (Mechanical Rooms) FD-3:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 2142.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.7.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom unless otherwise noted.
8. Coating on Interior and Exposed Exterior Surfaces: Enamel.
9. Sediment Bucket: 3-3/4 inches deep, slotted sediment bucket with lift bar.
10. Top or Strainer Material: Cast-iron.
11. Top Shape: Round.
12. Dimensions of Top or Strainer: 11-1/2 inch diameter tractor grate, 29 square inches of free area. Provide partial grate where required to accept equipment drains.
13. Top Loading Classification: Heavy Duty.
14. Outlet Fitting: Gray iron, with spigot outlet.
15. Trap Seal Protection Device: Required.

### 2.03 FLOOR SINKS

A. Stainless-Steel Floor Sink Drains FS-1:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.; Model 3006-8.
  - d. Tyler Pipe; Wade Div.
  - e. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.6.7.
3. Outlet: Bottom unless otherwise noted.
4. Top or Strainer Material: Stainless steel.
5. Top Shape: Square.
6. Dimensions of Top or Strainer: 8 inch by 8 inch, 14 gage, Type 304 stainless steel ribbed, non-tilt loose set half grate with 1/2 inch square holes and perforated stainless steel sediment bucket.
7. Seepage Flange: Required.
8. Clamping Device: Required.
9. Trap Seal Protection Device: Required.

### 2.04 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.



- B. Description: Manufactured assembly consisting of metal flashing collar and skirt extending at least 8 inches from pipe, with boot reinforcement and counterflashing fitting.

## 2.05 TRAP SEAL PROTECTION DEVICES

- A. Barrier Type Trap Seal Protection Devices:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Smith, Jay R. Mfg. Co.; Quad Close Trap Seal Device Fig. 2692.
    - b. SureSeal Manufacturing; Inline Floor Drain Trap Sealer.
  2. Standard: ASSE 1072-2007.
  3. Sealing Element: Neoprene rubber or chemically resistant elastomer.
  4. Size: 2 inch, 3 inch, 3-1/2 inch, or 4 inch.
  5. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

## 2.06 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ProSet Systems Inc.
  2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
  3. Size: Same as connected soil, waste, or vent stack.
  4. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
  5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
  6. Special Coating: Corrosion resistant on interior of fittings.

## 2.07 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

- A. Hub Outlets:
1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
  2. Size: Same as connected waste piping.
- B. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout.
  2. Size: Same as connected waste piping.
    - a. NPS 2: 4-inch- minimum water seal.
    - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.
- C. Air-Gap Fittings:
1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
  2. Body: Bronze or cast iron.
  3. Inlet: Opening in top of body.
  4. Outlet: Larger than inlet.
  5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.
- D. Sleeve Flashing Device:
1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
  2. Size: As required for close fit-to-riser or stack piping.
- E. Stack Flashing Fittings:
1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
  2. Size: Same as connected stack vent or vent stack.
- F. Vent Caps:
1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
  2. Size: Same as connected stack vent or vent stack.

- G. Downspout Boots:
  - 1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
  - 2. Size: Inlet size to match downspout.

## 2.08 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. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:
  - 1. General Applications: 12 oz./sq. ft.
  - 2. Vent Pipe Flashing: 8 oz./sq. ft.
- C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- E. Fasteners: Metal compatible with material and substrate being fastened.
- F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- G. Solder: ASTM B 32, lead-free alloy.
- H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## 2.09 GREASE INTERCEPTORS

- A. Grease Interceptors:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Josam Company; Josam Div.
    - b. Lowe Engineering; a div. of Highland Tank & Manufacturing Co., Inc.
    - c. MIFAB, Inc.
    - d. Schier Products Company.
    - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - f. Tyler Pipe; Wade Div.
    - g. Watts Drainage Products Inc.
    - h. Zurn Plumbing Products Group.
  - 2. Standard: ASME A112.14.3, for intercepting and retaining fats, oils, and greases from food-preparation or -processing wastewater.
  - 3. Plumbing and Drainage Institute Seal: Required.
  - 4. Body Material: Cast iron, steel, or polypropylene.
  - 5. Interior Lining: Corrosion-resistant enamel for cast iron or steel bodies. Not required for polypropylene bodies.
  - 6. Exterior Coating: Corrosion-resistant enamel for cast iron or steel bodies. Not required for polypropylene bodies.
  - 7. Body Extension: Required.
  - 8. Size and Capacities: As indicated on the drawings.
  - 9. Cleanout: field installed on outlet.
  - 10. Mounting: Recessed, flush with floor.
  - 11. Flow-Control Fitting: Required.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 20 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. 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.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches 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.
- F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- G. Install through-penetration firestop assemblies in plastic conductors and stacks at floor penetrations.
- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- K. Install vent caps on each vent pipe passing through roof.
- L. Install manufactured, gray-iron downspout boots at grade with top 12 inches above grade. Secure to building wall.
- M. Install wood-blocking reinforcement for wall-mounting-type specialties.
- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- O. 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.
- P. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
1. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
  2. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

### **3.2 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.
  2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, 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 7 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

**3.3 LABELING AND IDENTIFYING**

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Grease interceptors.
  - 2. Solids interceptors.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 20 Section "Mechanical Identification."

**3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled grease removal devices and their installation, including piping and electrical connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**3.5 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 14 13 - STORM DRAINAGE PIPING**

PART 1 - GENERAL .....	1
1.1 RELATED DOCUMENTS .....	1
1.2 DEFINITIONS .....	1
1.3 SYSTEMS DESCRIPTIONS .....	1
1.4 SUBMITTALS .....	1
1.5 QUALITY ASSURANCE .....	1
PART 2 - PRODUCTS .....	2
2.1 MANUFACTURERS .....	2
2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS .....	2
2.3 PVC PIPE AND FITTINGS .....	2
2.4 SPECIAL PIPE FITTINGS .....	2
PART 3 - EXECUTION .....	3
3.1 EXCAVATION .....	3
3.2 PIPING SYSTEM INSTALLATION .....	3
3.3 JOINT CONSTRUCTION .....	4
3.4 VALVE INSTALLATION .....	4
3.5 HANGER AND SUPPORT INSTALLATION .....	4
3.6 CONNECTIONS .....	5
3.7 FIELD QUALITY CONTROL .....	5
3.8 CLEANING .....	5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Drainage Piping Specialties."

**1.02 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. LLDPE: Linear, low-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PVC: Polyvinyl chloride plastic.
- E. TPE: Thermoplastic elastomer.

**1.03 SYSTEMS DESCRIPTIONS**

- A. Storm drainage piping system materials are scheduled on the Drawing.

**1.04 SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

**1.05 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Cast-iron soil pipe shall be marked with the collective trademark of Cast Iron Soil Pipe Institute (CISPI).
- C. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.
- D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be as recommended by the manufacturer of the grooved components.

## **PART 2 PRODUCTS**

### **2.01 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.

### **2.02 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 888 or CISPI 301.
- B. CISPI, Hubless-Piping Couplings:
1. Manufacturers:
    - a. ANACO-Husky; McWane Plumbing Group.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
    - c. IDEAL-TRIDON.
    - d. Mission Rubber Company; a division of MCP Industries, Inc.
    - e. Tyler Pipe; McWane Plumbing Group.
  2. Standards: CISPI 310.
  3. Description: NSF certified for compliance with CISPI 310. Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
- C. Heavy-Duty, Hubless-Piping Couplings:
1. Manufacturers:
    - a. ANACO-Husky; McWane Plumbing Group; SD 4000.
    - b. Ferguson Enterprises, Inc.; ProFlo (Private labeled IDEAL-TRIDON).
    - c. IDEAL-TRIDON; Heavy-Duty "HD" No-Hub Couplings.
    - d. Norma Group; Clamp-All Products; HI-TORQ 125.
  2. Standards: ASTM C 1277 and ASTM C 1540, or ASTM C 1277 and FM 1680 Class I.
  3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

### **2.03 PVC PIPE AND FITTINGS**

- A. Solid-Wall PVC Pipe: Schedule 40, ASTM D 2665, drain, waste, and vent.
1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

### **2.04 SPECIAL PIPE FITTINGS**

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
    - a. Dallas Specialty & Mfg. Co.
    - b. Fernco, Inc.
    - c. Logan Clay Products Company (The).
    - d. Mission Rubber Co.
    - e. NDS, Inc.
    - f. Plastic Oddities, Inc.
  2. Sleeve Materials:
    - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
    - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
    - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Shielded Nonpressure Pipe Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Mission Rubber Co.

- C. Pressure Pipe Couplings: AWWA C219 metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser, Inc.; DMD Div.
    - c. EBAA Iron Sales, Inc.
    - d. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    - e. JCM Industries, Inc.
    - f. Romac Industries, Inc.
    - g. Smith-Blair, Inc.
    - h. Viking Johnson.
  - 2. Center-Sleeve Material: Manufacturer's standard.
  - 3. Gasket Material: Natural or synthetic rubber.
  - 4. Metal Component Finish: Corrosion-resistant coating or material.
- D. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 1. Manufacturers:
    - a. SIGMA Corp.

### **PART 3 EXECUTION**

#### **3.01 EXCAVATION**

- A. Refer to Division 31 Section "Earthwork" for excavating, trenching, and backfilling.

#### **3.02 PIPING SYSTEM INSTALLATION**

- A. Storm sewer and drainage piping outside the building are specified in Division 33 Section "Storm Drainage."
- B. Basic piping installation requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- C. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 22 Section "Drainage Piping Specialties."
- D. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
- E. Install underground, ductile-iron, force-main piping according to AWWA C600. Install buried piping inside building between wall and floor penetrations and connection to storm sewer piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- F. Install underground, ductile-iron, special pipe fittings according to AWWA C600.
  - 1. Install encasement on piping according to ASTM A 674 or AWWA C105.
- G. Install underground, copper, force-main tubing according to Copper Development Association's "Copper Tube Handbook."
- H. 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 20 Section "Basic Mechanical Materials and Methods."
- I. 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."
- J. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Storm Drain: 1/8-inch per foot downward in direction of flow, unless otherwise noted.

2. Horizontal Storm-Drainage Piping: 1/8-inch per foot downward in direction of flow, unless otherwise noted.
- M. Install force mains at elevations indicated.
- N. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- O. Install PVC storm drainage piping according to ASTM D 2665.
- P. Install underground PVC storm drainage piping according to ASTM D 2321.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.03 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- C. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.04 VALVE INSTALLATION

- A. General valve installation requirements are specified in Division 20 Section "Valves."
- B. Shutoff Valves: Install shutoff valve on each sump pump discharge.
- C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sump pump discharge.
- D. Backwater Valves: Install backwater valves in piping subject to backflow.
  1. Horizontal Piping: Horizontal backwater valves.
  2. Install backwater valves in accessible locations.
  3. Backwater valves are specified in Division 22 Section "Drainage Piping Specialties."

### 3.05 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 20 Section "Hangers and Supports." Install the following:
  1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 20 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  2. NPS 3: 60 inches with 1/2-inch rod.
  3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  4. NPS 6: 60 inches with 3/4-inch rod.
  5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.
  6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.



### 3.06 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
- D. Connect force-main piping to the following:
  - 1. Storm Sewer: To exterior force main or storm manhole.
  - 2. Sump Pumps: To sump pump discharge.

### 3.07 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  - 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
  - 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 5. Prepare reports for tests and required corrective action.
- E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
  - 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 2. Cap and subject piping to static-water pressure of 150 psig, 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.
  - 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  - 4. Prepare reports for tests and required corrective action.

### 3.08 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.

**END OF SECTION**

This page intentionally left blank

**SECTION 22 33 00 - ELECTRIC DOMESTIC WATER HEATERS**

PART 1 - GENERAL .....	1
1.1 RELATED DOCUMENTS .....	1
1.2 SUBMITTALS .....	1
1.3 QUALITY ASSURANCE .....	1
1.4 COORDINATION .....	1
PART 2 - PRODUCTS .....	2
2.1 MANUFACTURERS .....	2
2.2 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS .....	2
2.3 EXPANSION TANKS .....	2
2.4 WATER HEATER ACCESSORIES .....	2
2.5 SOURCE QUALITY CONTROL .....	3
PART 3 - EXECUTION .....	3
3.1 WATER HEATER INSTALLATION .....	3
3.2 CONNECTIONS .....	3
3.3 FIELD QUALITY CONTROL .....	4
3.4 DEMONSTRATION .....	4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 SUBMITTALS**

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail water heater assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Product Certificates: For each type of electric water heater, signed by product manufacturer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For electric water heaters to include in operation and maintenance manuals.

**1.03 QUALITY ASSURANCE**

- A. Source Limitations: Obtain same type of electric water heaters through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of electric water heaters and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- D. ASME Compliance: Where indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. ASHRAE Standards: Comply with performance efficiencies prescribed for the following:
  - 1. ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," for commercial water heaters.
- F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for all components that will be in contact with potable water.

**1.04 COORDINATION**

- A. Coordinate size and location of concrete bases with Architectural and Structural Drawings.

## **PART 2 PRODUCTS**

### **2.01 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.

### **2.02 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS**

- A. Description: Comply with UL 174 for household, storage electric water heaters.
1. Manufacturers:
    - a. Bradford White Corporation.
    - b. Lochinvar Corporation; .
    - c. PVI Industries, LLC;.A Watts Brand; Durawatt CL Series
    - d. Smith, A. O. Water Products Company.
    - e. Bock Water Heaters, Inc.
  2. Storage-Tank Construction: Steel, vertical arrangement.
    - a. Tappings: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 125 psig.
    - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
  3. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium required for glass lined tanks.
    - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: ASSE 1005.
    - d. Insulation: Comply with ASHRAE/IESNA 90.1.
    - e. Jacket: Steel with enameled finish.
    - f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
    - g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.
    - h. Temperature Control: Adjustable thermostat for each element.
    - i. Safety Control: High-temperature-limit cutoff device or system.
    - j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
  4. Capacity and Characteristics: Refer to Schedule on Drawings.

### **2.03 EXPANSION TANKS**

- A. Description: Steel, pressure-rated tank, ASME-code constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
1. Manufacturers:
    - a. AMTROL Inc.
    - b. Armstrong Pumps, Inc.
    - c. Bell & Gossett; Xylem Inc.
    - d. Taco, Inc.
    - e. Wessels Co.
  2. Construction:
    - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
  3. Capacity and Characteristics: Refer to Schedule on Drawings.

### **2.04 WATER HEATER ACCESSORIES**

- A. Combination Temperature and Pressure Relief Valves: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- C. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

## **2.05 SOURCE QUALITY CONTROL**

- A. Test and inspect water heater storage tanks, specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test water heater storage tanks before shipment to minimum of one and one-half times pressure rating.
- C. Prepare test reports.

## **PART 3 EXECUTION**

### **3.01 WATER HEATER INSTALLATION**

- A. Install commercial water heaters on concrete bases.
  - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
  - 2. Concrete base construction requirements are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- B. Install 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.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend 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.
- D. Install combination temperature and pressure relief valves in water piping for 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.
- E. 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 water heaters that do not have tank drains. Refer to Division 20 Section "Valves" for hose-end drain valves.
- F. Install thermometer on outlet piping of water heaters. Refer to Division 20 Section "Meters and Gages" for thermometers.
- G. Install pressure gage(s) on outlet of commercial electric water-heater piping. Refer to Division 20 Section "Meters and Gages" for pressure gages.
- H. Assemble and install inlet and outlet piping manifold kits for multiple water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each water heater. Include shutoff valve, thermometer in each water heater inlet and outlet, and throttling valve in each water heater outlet. Refer to Division 20 Section "Valves" for general-duty valves and to Division 20 Section "Meters and Gages" for thermometers.
- I. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- J. Fill water heaters with water.
- K. Charge compression tanks with air.

### **3.02 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.03 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove water heaters that do not pass tests and inspections. Replace with water heaters meeting Contract requirements and retest as specified above.

### **3.04 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters.

**END OF SECTION**

**SECTION 22 42 00 - PLUMBING FIXTURES**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 SUBMITTALS ..... 2  
1.4 QUALITY ASSURANCE ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 WATER CLOSETS ..... 2  
2.2 WATER CLOSET FLUSHOMETERS ..... 3  
2.3 TOILET SEATS ..... 3  
2.4 LAVATORIES ..... 3  
2.5 LAVATORY FAUCETS ..... 4  
2.6 COMMERCIAL SINKS, CS-1 ..... 4  
2.7 SINK FAUCETS ..... 5  
2.8 FIXTURE SUPPLIES ..... 5  
2.9 PROTECTIVE SHIELDING GUARDS ..... 5  
2.10 FIXTURE SUPPORTS ..... 6  
PART 3 - EXECUTION ..... 6  
3.1 EXAMINATION ..... 6  
3.2 INSTALLATION ..... 6  
3.3 CONNECTIONS ..... 7  
3.4 FIELD QUALITY CONTROL ..... 7  
3.5 ADJUSTING ..... 7  
3.6 CLEANING ..... 7  
3.7 PROTECTION ..... 8

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 22 Section "Drinking Fountains."
  - 4. Division 22 Section "Domestic Water Piping Specialties" for backflow preventers; individual-fixture, water tempering valves; and specialty fixtures not included in this Section.
  - 5. Division 22 Section "Drainage Piping Specialties" for floor drains, and specialty fixtures not included in this Section.

**1.02 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. Cast Polymer: Cast-filled-polymer-plastic material. This material includes cultured-marble and solid-surface materials.
- D. Cultured Marble: Cast-filled-polymer-plastic material with surface coating.
- E. Fitting: Device that controls the flow of water into or out of the plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.
- F. FRP: Fiberglass-reinforced plastic.
- G. PMMA: Polymethyl methacrylate (acrylic) plastic.
- H. PVC: Polyvinyl chloride plastic.
- I. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

### 1.03 SUBMITTALS

- A. Product Data: For each type of plumbing fixture indicated. Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports. Indicate materials and finishes, dimensions, construction details, and flow-control rates.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.
- D. Operation and Maintenance Data: For plumbing fixtures and trim to include in operation and maintenance manuals.

### 1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.
  - 1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities" Public Law 101-336, "Americans with Disabilities Act": for plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- E. Regulatory Requirements: Comply with requirements in Public Law 111-380, "Reduction of Lead in Drinking Water Act," about lead content in materials that will be in contact with potable water for human consumption.
- F. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," and NSF 372 Drinking Water System Components – Lead Content for potable domestic water piping and components.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with applicable ANSI, ASME, ASSE, ASTM, ICC, NSF, and UL standards and other requirements specified for plumbing fixtures, trim, fittings, components, and features.

## PART 2 PRODUCTS

### 2.01 WATER CLOSETS

- A. Water Closets, WC-1:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.; Madera 15 Elongated Toilet.
    - b. Kohler Co.
    - c. Sloan Valve Company.
    - d. Zurn Plumbing Products Group.
  - 2. Description: Standard height, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
    - a. Style: Flushometer valve.
      - 1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
      - 2) Supply Spud Location: Top.
      - 3) Height: 15 inches, standard height.
      - 4) Design Consumption: 1.6 gal./flush.
      - 5) Color: White.
    - b. Flushometer: FV-2-1.
    - c. Toilet Seat: TS-1.
- B. Water Closets, WC-2:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.; Madera 16-1/2 Elongated Toilet.
    - b. Kohler Co.; K-4405.
    - c. Sloan Valve Company.
    - d. Zurn Plumbing Products Group.



2. Description: Accessible, floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
  - a. Style: Flushometer valve.
    - 1) Bowl Type: Elongated with siphon-jet design. Include bolt caps matching fixture.
    - 2) Supply Spud Location: Top.
    - 3) Height: 16-1/2 to 16-3/4 inches, universal/accessible.
    - 4) Design Consumption: 1.6 gal./flush.
    - 5) Color: White.
  - b. Flushometer: FV-2-1.
  - c. Toilet Seat: TS-1.

## 2.02 WATER CLOSET FLUSHOMETERS

- A. Flushometers, FV-2-1:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Coyne & Delany Co.; Flushboy.
    - b. Delta Faucet Company; 81T Series.
    - c. Kohler Co. Wave K 10674.
    - d. Moen Commercial; 8310.
    - e. Sloan Valve Company.
    - f. Speakman Company; SWCV-2230.
    - g. Zurn Plumbing Products Group; ZER6000-WS1-CP.
  2. Description: Flushometer for water-closet-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, courtesy flush feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
    - a. Internal Design: Diaphragm or piston operation.
    - b. Style: Exposed.
    - c. Inlet Size: NPS 1.
    - d. Trip Mechanism: Battery-operated sensor actuator.
    - e. Consumption: 1.6 gal./flush.
    - f. Tailpiece Size: NPS 1-1/2 and standard length to top of bowl.

## 2.03 TOILET SEATS

- A. Toilet Seats, TS-1:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bemis Manufacturing Company; 1955SSC/1955SSCT.
    - b. Centoco Manufacturing Corp.
    - c. Church Seats; 295SSC/295SSCT.
    - d. Ferguson Enterprises, Inc.; ProFlo PFTSCOF2000WH.
    - e. Olsonite Seat Company; Model 10SSC/10SSCT.
    - f. Sanderson Plumbing Products, Inc.; Beneke Div.
    - g. Zurn Plumbing Products Group; 5955STS-WH.
  2. Description: Toilet seat for water-closet-type fixture.
    - a. Material: Molded, solid plastic.
    - b. Configuration: Open front without cover.
    - c. Size: Elongated.
    - d. Hinge Type: SC, self-sustaining, check.
    - e. Class: Standard commercial.
    - f. Color: White.

## 2.04 LAVATORIES

- A. Lavatories, LAV-1:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.; Lucerne Model 0355.012.
    - b. Ferguson Enterprises, Inc.; ProFlo PF5504.
    - c. Kohler Co.; K 2005 Kingston.
    - d. Sloan Valve Company.
    - e. Zurn Plumbing Products Group; Z5344.

2. Description: Accessible, wall-mounting, vitreous-china fixture.
  - a. Type: With contoured back and side shields.
  - b. Size: 20 by 18 inches rectangular.
  - c. Faucet Hole Punching: Three holes, 2-inch centers.
  - d. Color: White.
  - e. Faucet: LF-1.
  - f. Water Temperature Limiting Device: Required.
  - g. Drain: Grid with offset waste.
  - h. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; NPS 1-1/4, 17 gage tubular brass waste to wall; and wall escutcheon.
  - i. Fixture Support: Lavatory with concealed arms.
- B. Lavatories, LAV-2:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.; Aqualyn Model 0475.028.
    - b. Ferguson Enterprises, Inc.; ProFlo PF5204.
    - c. Kohler Co.; K 2196-4 Pennington.
    - d. Sloan Valve Company.
    - e. Zurn Plumbing Products Group; Z5114.
  2. Description: Accessible, counter-mounting, vitreous-china fixture.
    - a. Type: Self-rimming.
    - b. Oval Lavatory Size: 20 by 17 inches.
    - c. Faucet Hole Punching: Three holes, 2-inch centers.
    - d. Color: White.
    - e. Faucet: LF-1.
    - f. Water Temperature Limiting Device: Required.
    - g. Drain: Grid.
    - h. Drain Piping: NPS 1-1/4 chrome-plated, cast-brass P-trap; NPS 1-1/4, 17 gage tubular brass waste to wall; and wall escutcheon.

## 2.05 LAVATORY FAUCETS

- A. Lavatory Faucets, LF-1:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.; Innsbrook Model 6055.205.
    - b. Chicago Faucets; Model 115.737.21.1.
    - c. Delta Faucet Company; Model 591-LGHGMHDF.
    - d. Geberit Manufacturing, Inc.
    - e. Kohler Co.; K13461 (with K13478-A escutcheon).
    - f. Moen Commercial.
    - g. Sloan Valve Company.
    - h. Speakman Company.
  2. Description: Single hole faucet with escutcheon suitable for 4 inch centers, grid strainer, and no lift rod hole.
    - a. Body Material: Commercial, solid brass.
    - b. Finish: Polished chrome plate.
    - c. Mounting: Deck, concealed.
    - d. Inlet(s): NPS 1/2.
    - e. Spout Outlet: Vandal resistant spray, 0.5 gpm.
    - f. Operation: Sensor/Battery.

## 2.06 COMMERCIAL SINKS, CS-1

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elkay Manufacturing Co.
  - b. Franke Consumer Products, Inc., Commercial Div.
  - c. Just Manufacturing Company.
  - d. Moen Commercial.
2. Description: Single rectangular deep bowl, counter-mounting lay-in stainless-steel sink.

- a. Overall Dimensions: 28 inches by 20 inches.
- b. Metal Thickness: 18 gage, with sound dampened underside.
- c. Bowl:
  - 1) Dimensions: 24 inches by 16 inches by 12 inches deep.
  - 2) Drain: 3-1/2 inch grid.
- d. Sink Faucet: SF-2.
- e. Water Temperature Limiting Device: Required
- f. Supplies: NPS 1/2 chrome-plated copper with stops.
- g. Drain: Grid.
- h. Drain Piping: NPS 1-1/2 chrome-plated, cast-brass P-trap; 17 gage tubular brass waste to wall; and wall escutcheon.
- i. Disposer: Not required

## 2.07 SINK FAUCETS

- A. Sink Faucets, SF-1:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.
    - b. Chicago Faucets; No. 631-R.
    - c. Delta Faucet Company; Model 28C4934-R2.
    - d. Elkay Manufacturing Co.; LK940GNO8T4H.
    - e. Kohler Co.; K7320-4.
    - f. Moen Commercial.
    - g. Speakman Company; SC-5749.
    - h. T & S Brass and Bronze Works, Inc.
    - i. Zurn Plumbing Products Group; Z842B4.
  2. Description: Commercial/Industrial sink faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
    - a. Body Material: Commercial, solid brass.
    - b. Finish: Polished chrome plate.
    - c. Mixing Valve: Two handle.
    - d. Centers: 8 inches
    - e. Mounting: Back/wall.
    - f. Handle(s): Wrist blade, 4 inches
    - g. Operation: Noncompression, manual.
    - h. Inlet(s): NPS 1/2
    - i. Spout Type: 70 to 120-degree restricted swing 8 inch gooseneck.
    - j. Spout Outlet: Aerator.
    - k. Maximum Flow Rate:
      - 1) 1.5 gpm
      - 2) 1.59 gpm
      - 3) 2.2 gpm

## 2.08 FIXTURE SUPPLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. BrassCraft; a Masco Company.
  2. McGuire Mfg. Co., Inc.
  3. Any of the approved plumbing fixture manufacturers.
- B. Description: Chrome-plated brass, loose-key or screwdriver angle stops with brass stems; rigid, chrome-plated copper risers; and chrome-plated wall flanges.

## 2.09 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Engineered Brass Co.
    - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
    - c. McGuire Manufacturing Co., Inc.

- d. Plumberex Specialty Products Inc.
  - e. TCI Products; SG-200BV.
  - f. TRUEBRO, Inc.
  - g. Zurn Plumbing Products Group; Z8946-3-NT.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## 2.10 FIXTURE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Josam Company.
  2. MIFAB Manufacturing Inc.
  3. Smith, Jay R. Mfg. Co.
  4. Tyler Pipe; Wade Div.
  5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. Urinal Supports:
  1. Description: For wall-mounting, urinal-type fixture. Include steel uprights with feet.
  2. Accessible-Fixture Support: Include rectangular steel uprights.
- C. Lavatory Supports:
  1. Description: Lavatory carrier with concealed arms and tie rods for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
  2. Accessible-Fixture Support: Include rectangular steel uprights.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine cabinets, counters, floors, and walls for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 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 counter-mounting fixtures in and attached to casework.
- G. Install fixtures level and plumb according to roughing-in drawings. Install accessible fixtures at heights required by local codes.
- H. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
  1. Exception: Fixtures with flushometer valves, and faucets or valves with integral stops.
- I. Install ASSE 1070 water-temperature limiting devices on supplies for lavatories and sinks that will be used for handwashing, and where specified. Refer to Division 20 Section "Domestic Water Piping Specialties."
- J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- L. Install protective shielding guards on exposed traps and supplies of lavatories.
- M. Install toilet seats on water closets.

- N. 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.
- O. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- P. 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.
- Q. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- R. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- S. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Division 20 Section "Basic Mechanical Materials and Methods."
- T. Set service basins in leveling bed of cement grout. Grout is specified in Division 20 Section "Basic Mechanical Materials and Methods."
- U. 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 7 Section "Joint Sealants."

### 3.03 CONNECTIONS

- A. Piping installation requirements are specified in other Division 20 and 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. Individual water line branches, waste lines, vents, and traps for connection to individual fixtures, fixture fittings and specialties shall be in accordance with the schedule on the Drawings.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.04 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.

### 3.05 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers and controls. Replace damaged and malfunctioning units and controls.
- C. Adjust water pressure at faucets to produce proper flow and stream.
- D. Adjust flow at laboratory faucets having serrated nozzles to prevent splashing.
- E. Replace washers and seals, or cartridges of leaking and dripping faucets and stops.

### 3.06 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.
- B. After completing installation of exposed, factory-finished fixtures, faucets, and fittings, inspect exposed finishes and repair damaged finishes.

**3.07 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 47 00 - DRINKING FOUNTAINS, WATER COOLERS, AND CUSPIDORS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
PART 2 - PRODUCTS ..... 2  
2.1 PRESSURE (ELECTRIC) WATER COOLERS ..... 2  
2.2 FIXTURE SUPPORTS ..... 2  
PART 3 - EXECUTION ..... 2  
3.1 EXAMINATION ..... 2  
3.2 APPLICATIONS ..... 2  
3.3 INSTALLATION ..... 3  
3.4 CONNECTIONS ..... 3  
3.5 ADJUSTING ..... 3  
3.6 CLEANING ..... 3

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 DEFINITIONS**

- A. Accessible Drinking Fountain: Fixture that can be approached and used by people with disabilities.
- B. Cast Polymer: Dense, cast-filled-polymer plastic.
- C. Drinking Fountain: Fixture with nozzle for delivering stream of water for drinking.
- D. Fitting: Device that controls flow of water into or out of fixture.
- E. Fixture: Drinking fountain.
- F. TDS: Total dissolved solids.

**1.03 SUBMITTALS**

- A. Product Data: For each fixture indicated. Include rated capacities, furnished specialties, and accessories.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For fixtures to include in emergency, operation, and maintenance manuals.

**1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL 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" for fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in the U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about fixtures for people with disabilities.
- 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. AHRI Standard: Comply with AHRI's "Directory of Certified Drinking Water Coolers" for 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**

### **2.01 PRESSURE (ELECTRIC) WATER COOLERS**

- A. Water Coolers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elkay Manufacturing Co.; VRC8WSK/VRCTL8WSK
    - b. Halsey Taylor; SCWT Series.
    - c. Haws Corporation; HF Series.
    - d. Murdock Manufacturing; A Member of Morris Group International; A611108F.
    - e. Oasis Corporation; PLF Series.
    - f. Sunroc Corp.; NSF Series.
  - 2. Description: AHRI 1010, Type PB, pressure with bubbler, Style F, Wall Mounted single (EWC-1) / dual station (EWC-1) water cooler with Bottle filler – vandal resistant, indoor/outdoor
    - a. Cabinet: Stainless Steel and stainless-steel top;
    - b. Bubbler: One, flexible or elastomeric overmolded, with adjustable stream regulator, located on deck.
    - c. Control: vandal resistant Push button.
    - d. Bottle Filling Station
    - e. Supply: NPS 3/8 with isolation valve.
    - f. Drain: Grid with NPS 1-1/4 minimum horizontal waste and trap complying with ASME A112.18.2.
    - g. 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.
      - 1) Capacity: 8 gph of 50 deg F cooled water from 80 deg F inlet water and 90 deg F ambient air temperature.
      - 2) Electrical Characteristics: 1/5 hp; 120-V ac; single phase; 60 Hz.

### **2.02 FIXTURE SUPPORTS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Josam Co.
  - 2. MIFAB Manufacturing, Inc.
  - 3. Smith, Jay R. Mfg. Co.; A Member of Morris Group International.
  - 4. Tyler Pipe; Wade Div.
  - 5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
  - 6. Zurn Plumbing Products Group; Specification Drainage Operation.
- B. 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**

### **3.01 EXAMINATION**

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before fixture installation. Verify that sizes and locations of piping and types of supports match those indicated.
- B. Examine walls and floors for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 APPLICATIONS**

- A. Use carrier off-floor supports for wall-mounting fixtures, unless otherwise indicated.
- B. Use chrome-plated brass or copper tube, fittings, and valves in locations exposed to view. Plain copper tube, fittings, and valves may be used in concealed locations.



### **3.03 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, gate, or globe valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Division 20 Section "Valves."
- 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 20 Section "Basic Mechanical Materials and Methods."
- 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 7 Section "Joint Sealants."

### **3.04 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 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.

### **3.05 ADJUSTING**

- A. Adjust fixture flow regulators for proper flow and stream height.

### **3.06 CLEANING**

- A. After completing fixture installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

**END OF SECTION**

This page intentionally left blank

**SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUMMARY ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
1.5 ENVIRONMENTAL REQUIREMENTS ..... 1  
PART 2 - PRODUCTS ..... 2  
2.1 MANUFACTURERS ..... 2  
2.2 FAN SHAFTS ..... 2  
2.3 FAN POWER TRANSMISSION ..... 2  
2.4 SHEAVES ..... 2  
2.5 V-BELT FAN DRIVES ..... 2  
2.6 FAN DRIVE, SHAFT, AND COUPLING GUARDS ..... 2  
2.7 BELT DRIVE GUARDS ..... 3  
2.8 V-BELTS ..... 3  
2.9 V-BELT DRIVE MOTOR BASES ..... 3  
2.10 AIR HANDLING SYSTEM BALANCING PROVISIONS ..... 3  
2.11 FLEXIBLE COUPLINGS (DIRECT DRIVE) ..... 3  
2.12 MOTOR REQUIREMENTS ..... 3  
2.13 FAN BEARINGS ..... 4  
2.14 IDENTIFICATION ..... 4  
2.15 ACCESSORIES ..... 4  
PART 3 - EXECUTION ..... 4  
3.1 INSTALLATION ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."
  - 3. Division 23 Section "Testing, Adjusting, and Balancing."

**1.02 SUMMARY**

- A. This Section includes common requirements for existing fans and air moving equipment.

**1.03 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Fan bearings.
  - 2. V-belt fan drives.
  - 3. Direct drive couplings.

**1.04 QUALITY ASSURANCE**

- A. Electrical Characteristics for HVAC 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.
- B. Fan Performance Data: AMCA Standard 210.
- C. Sound Power Level Ratings:
  - 1. Ducted Fans - Rated per AMCA 301, when tested per AMCA 300.
  - 2. Nonducted Fans - Rated in Zones at 5 feet from acoustic center of fan rated per AMCA 301, tested per AMCA 300 and converted per AMCA 302.

**1.05 ENVIRONMENTAL REQUIREMENTS**

- A. Do not operate equipment for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### **2.02 FAN SHAFTS**

- A. Fan Shafts: Ground from solid cold rolled steel, and proportioned to run at least 25 percent below the first critical speed.

### **2.03 FAN POWER TRANSMISSION**

- A. V-Belt Type Fan Drives: In accordance with Engineering Standard Specification for Drives Using Multiple V-Belts, sponsored by the Mechanical Power Transmission Association and the Rubber Manufacturer's Association.
- B. A given manufacturer's V-belt drive, as applied to specific equipment provided under the Contract, shall conform to the equipment manufacturer's published recommendations, except as otherwise specified.
- C. Base horsepower rating of drive on minimum pitch diameter of small sheave.
- D. Locate belt drives outboard of bearings. Align drive and driven shafts by the four-point method.
- E. Adjust belt tension in accordance with the manufacturer's recommendations.
- F. Perform alignment and final belt tensioning in the presence of the Architect.

### **2.04 SHEAVES**

- A. Furnish sheaves of machined cast iron or carbon steel, bushing type of fixed bore, secured to the shaft by key and keyway.
- B. For all constant speed fans at or above 2 inches of total static pressure, Contractor shall provide and install two sets of fixed sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after system balance is complete and shall be based on actual field conditions.
- C. For all constant speed fans below 2 inches total static pressure, Contractor shall provide and install two sets of adjustable sheaves. First set shall be installed for initial start-up and shall be based on scheduled data. The second set shall be installed after the balance is complete and shall be based on actual field conditions, and selected at mid-range of the sheave.
- D. Set pitch diameters of fixed pitch and adjustable or variable pitch sheaves when adjusted as specified, at not less than that recommended by NEMA Standard MG1-14.42.
- E. For companion sheaves for adjustable or variable pitch drives, furnish wide groove spacing to match driving sheaves.
- F. For all variable frequency controller (VFC) operated fans, contractor shall provide and install one set of fixed sheaves sized to allow full utilization of fan motor horsepower provided, with VFC at 100 percent of fan motor RPM.

### **2.05 V-BELT FAN DRIVES**

- A. Fan Drives: Multiple V-belt style with adjustable pitch driver sheaves for fans up to 2 inches of total static pressure and fixed pitch driver sheaves for fans at or above 2 inches of total static pressure and up. Sheaves shall have split, taper style bushings. Drives shall be selected for a 150 percent service factor and shall provide for adjustment of both belt tension and alignment.
- B. Manufacturers:
  - 1. Emerson Power Transmission; Browning.
  - 2. Rockwell Automation; Dodge.
  - 3. T.B. Wood's Incorporated.

### **2.06 FAN DRIVE, SHAFT, AND COUPLING GUARDS**

- A. Safety Provisions: Include guards and screens for power transmission equipment, but do not negate vibration isolation provision.

- B. Furnish ANSI and OSHA compliant mechanical power transmission apparatus guards except where superseded by other governing codes, and except as modified and supplemented. Requirements specified apply to all types of fans.
- C. Fabricate mechanical power transmission device guards such that the completed structure is capable of withstanding a load of at least 200 pounds applied in any direction.
- D. Furnish a guard enclosure for each V-belt drive, coupling, shaft, and rotating component. Secure guards in place, easily removable for maintenance. Guard fasteners used for maintenance access shall be "captive type." Locate holes on each guard for tachometer readings on both the motor and fan shafts. Fabricate guard of minimum 16 gage sheet metal with hemmed edges at openings for shafts. Weld four mounting lugs or feet of 10 gage material to the guard. Fabricate guards for couplings five inches in diameter and larger of 12 gage sheet metal. Furnish holes in mounting feet sized for suitable machine screws.
- E. Centrifugal exhaust fans shall be provided with shaft seals.

#### **2.07 BELT DRIVE GUARDS**

- A. Belt Guards: ANSI and OSHA compliant with provision for readily viewing belt tension and measuring shaft speeds. Guards shall be installed with quick release pins, so that removal of three to five clip pins, will allow the guard to be removed from fan housing.
- B. Fabricate guards which completely enclose moving parts of the particular drive. Design and construct guards of such rigidity as to contain a belt which breaks during operation. Minimum material thickness, 16 gage sheet metal. Where ventilation is required, perforated metal shall be used for the sides. Fabricate top of solid sheet metal.

#### **2.08 V-BELTS**

- A. Notched or cogged style, endless type, of Dacron reinforced elastomer construction, with cross-section to suit sheave grooves. Determine the number of V-belts from the motor horsepower to which apply the service factor to obtain the design horsepower. Determine the corrected horsepower per belt by multiplying the nominal horsepower per belt by an arc of contact factor not greater than 0.85. Divide the design horsepower by the corrected horsepower per belt to obtain the number of belts required. In any case, furnish not less than two belts for each drive.
- B. Furnish belts that have been factory or factory-authorized distributor matched and measured on a belt-matching machine. Selection by "code numbers," "sag numbers" or "match numbers" is not acceptable. Bind each belt set with wire and tag with equipment identification.
- C. Manufacturers:
  - 1. Emerson Power Transmission; Browning; AX, BX, and CX Series and 3VX and 5VX Series.
  - 2. Rockwell Automation; Dodge; Classic Cog and Narrow Cog V-Belts.
  - 3. T.B. Wood's Incorporated; Classical Cog and Narrow Cog V-Belts.

#### **2.09 V-BELT DRIVE MOTOR BASES**

- A. Furnish fan motors with slide or adjustable pivoted bases wherever equipment configuration permits proper installation.
- B. Provide for adjustment of both belt tension and alignment.

#### **2.10 AIR HANDLING SYSTEM BALANCING PROVISIONS**

- A. Provide extra sheaves, sized as recommended by the Balancing Agent, for the adjustment of fan speed for each air handling system during air quantity balancing operations. Furnish sheaves as specified in this Section.

#### **2.11 FLEXIBLE COUPLINGS (DIRECT DRIVE)**

- A. Fan shaft shall be connected to the motor shaft through a flexible coupling. The flexible member shall be a tire shape, in shear, or a solid mass serrated edge disc shape, made of chloroprene materials and retained by fixed flanges. Flexible coupling shall act as a dielectric connector and shall not transmit sound, vibration or end thrust.
- B. Manufacturer:
  - 1. Falk Corporation (The).

#### **2.12 MOTOR REQUIREMENTS**

- A. Furnish motors in accordance with Division 20 Section "Motors."

### **2.13 FAN BEARINGS**

- A. Bearings: Anti-friction ball or roller type with provision for self-alignment and thrust load. Made in U.S.A. with ABMA L<sub>10</sub> minimum life of 200,000 hours. Use cast iron housings and dust-tight seals suitable for lubricant pressures.
  - 1. Lubrication Provisions - Use surface ball check type supply fittings. Provide extension tubes to allow safe maintenance while equipment is operating. Provide manual or automatic pressure relief fittings to prevent overheating or seal blow-out due to excess lubricant or pressure. Arrange relief fittings opposite supply but visible for normal maintenance observation.
  - 2. Bearings on Equipment with less than 1/2 horsepower rating or on shafts smaller than 1-3/4 inch in diameter: Permanently sealed, pre-lubricated anti-friction bearings per specified materials and ABMA L<sub>10</sub> life requirements.

### **2.14 IDENTIFICATION**

- A. Nameplate: Affix metallic, corrosion-resistant data plate for each fan in a conspicuous location. Include selection point capacity conditions.

### **2.15 ACCESSORIES**

- A. Bird Screens: Of material to match adjacent contact construction, 1/2 inch mesh or equal expanded metal. Use on inlet or outlet of each nonducted fan.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Field Rigging: Do not negate balancing. Do not bend shaft. Use lifting eyes.
- B. Install sheaves where recommended by Testing, Adjusting, and Balancing agency.
- C. Refer to individual Division 23 HVAC equipment Sections for additional requirements.

**END OF SECTION**

**SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING**

PART 1 - GENERAL .....	1
1.1 RELATED DOCUMENTS .....	1
1.2 SUMMARY .....	1
1.3 DEFINITIONS .....	1
1.4 SUBMITTALS .....	2
1.5 QUALITY ASSURANCE .....	2
1.6 PROJECT CONDITIONS .....	3
1.7 COORDINATION .....	3
1.8 WARRANTY .....	3
PART 2 - PRODUCTS (NOT APPLICABLE) .....	3
PART 3 - EXECUTION .....	3
3.1 EXAMINATION .....	3
3.2 PREPARATION .....	4
3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING .....	4
3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS .....	4
3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS .....	5
3.6 PROCEDURES FOR MOTORS .....	5
3.7 TOLERANCES .....	6
3.8 REPORTING .....	6
3.9 FINAL REPORT .....	6
3.10 INSPECTIONS .....	8
3.11 ADDITIONAL TESTS .....	8

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 SUMMARY**

- A. This Section includes testing, adjusting, and balancing to produce design objectives for the following:
  - 1. Air Systems:
    - a. Constant air volume systems.
  - 2. Verifying that automatic control devices are functioning properly.
  - 3. Reporting results of activities and procedures specified in this Section.
- B. Include rebalancing of air systems, or system portions affected by recommended sheave changes.

**1.03 DEFINITIONS**

- A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. AHJ: Authority having jurisdiction.
- C. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.
- D. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.
- E. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- F. NC: Noise criteria.
- G. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- H. RC: Room criteria.
- I. Report Forms: Test data sheets for recording test data in logical order.

- J. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- K. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- L. TAB: Testing, adjusting, and balancing.
- M. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- N. Test: A procedure to determine quantitative performance of systems or equipment.
- O. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

#### **1.04 SUBMITTALS**

- A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- E. Sample Report Forms: Submit two sets of sample TAB report forms.
- F. Warranties specified in this Section.

#### **1.05 QUALITY ASSURANCE**

- A. TAB Firm Qualifications: Engage a TAB firm certified by either AABC or NEBB.
- B. Smoke Control System Testing: Additional Qualifications: The TAB firm shall be a qualified special inspector for the smoke control systems. The TAB firm for the smoke control system shall have expertise in fire protection engineering, mechanical engineering, and certification as air balancers.
- C. Approved Balancing Agencies.
  - 1. The TAB firm selected shall be from the following list:
    - a. Absolut Balance Company, Inc.; South Lyon, MI.
    - b. Air Solutions, Inc.; Lapeer, MI.
    - c. Airflow Testing Inc.; Lincoln Park, MI.
    - d. Barmatic Inspecting Co., Inc.; Lincoln Park, MI.
    - e. Control Solutions, Inc.; Byron Center, MI.
    - f. Ener-Tech Testing; Holly, MI.
    - g. Enviro-Aire/Total Balance Co.; St. Clair Shores, MI.
    - h. International Test & Balance Inc.; Southfield, MI.
    - i. Quality Air Service; Portage, MI.
- D. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items: Include at least the following:
    - a. Submittal distribution requirements.
    - b. The Contract Documents examination report.
    - c. TAB plan.
    - d. Work schedule and Project-site access requirements.
    - e. Coordination and cooperation of trades and subcontractors.
    - f. Coordination of documentation and communication flow.
- E. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.



2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.
- F. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems." TAB firm's forms approved by Architect.
- G. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- H. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.
  1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

#### **1.06 PROJECT CONDITIONS**

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

#### **1.07 COORDINATION**

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Notice: Provide seven days advance notice for each test. Include scheduled test dates and times.
- C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

#### **1.08 WARRANTY**

- A. National Project Performance Guarantee: If AABC standards are used, provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
  1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  2. Systems are balanced to optimum performance capabilities within design and installation limits.
- B. Special Guarantee: If NEBB standards are used, provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
  1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  2. Systems are balanced to optimum performance capabilities within design and installation limits.

#### **PART 2 PRODUCTS (NOT APPLICABLE)**

#### **PART 3 EXECUTION**

##### **3.01 EXAMINATION**

- A. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- B. Examine system and equipment test reports.
- C. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- D. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- E. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- F. Examine equipment for installation and for properly operating safety interlocks and controls.
- G. Examine automatic temperature system components to verify the following:
  1. Dampers and other controlled devices are operated by the intended controller.

2. Dampers are in the position indicated by the controller.
  3. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions.
  4. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  5. Sensors are located to sense only the intended conditions.
  6. Sequence of operation for control modes is according to the Contract Documents.
  7. Controller set points are set at indicated values.
  8. Interlocked systems are operating.
- H. 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.

### **3.02 PREPARATION**

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
  1. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.
  2. Maximum Allowable Leakage: Leakage rates are scheduled on the Drawings.
- C. Complete system readiness checks and prepare system readiness 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. Balance, smoke, and fire dampers are open.
  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.

### **3.03 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 Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- B. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, fan-speed-control levers, and similar controls and devices, to show final settings.
- C. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.04 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, or use reduced scale contract documents with notations.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Cut insulation, and drill ducts for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes with neat patches, neoprene plugs, threaded plugs, or threaded twist-on metal caps, and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- E. Check air flow within intake plenums and mixing boxes of air handling units for uneven flow and temperature stratification and prepare a report with profile elevations (temperature and velocity) on each coil or filter face for Architect.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.

- I. Check for airflow blockages.
- J. Check for proper sealing of air-handling unit components.
- K. Check for proper sealing of air duct system.

### **3.05 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 fan static pressures to determine actual static pressure as follows:
    - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from 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.
  - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
  - 4. Select required sheave sizes and advise installing contractor to change drive sheaves accordingly. Refer to Division 23 Section "Common Work Results for HVAC" for additional requirements.
  - 5. Do not recommend 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 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 at a point downstream from the balancing damper and adjust volume dampers until the proper airflow is achieved.
    - 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. 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 terminal 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 terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using 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.

### **3.06 PROCEDURES FOR MOTORS**

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer, model, and serial numbers.
  - 2. Motor horsepower rating.
  - 3. Motor rpm.
  - 4. Efficiency rating.
  - 5. Power factor.
  - 6. Nameplate and measured voltage, each phase.
  - 7. Nameplate and measured amperage, each phase.
  - 8. Starter size.
  - 9. Starter thermal-protection-element rating.
  - 10. Fuse number and size.

- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

### 3.07 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Air handling equipment and outlets: Plus or minus 5 percent.
    - a. Where terminal units serve 6 or more outlets within a common room, individual outlets may vary up to plus or minus 10 percent of design flow rates if overall room supply is within plus or minus 5 percent.

### 3.08 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.09 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. 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, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 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 firm 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. Notes to explain why certain final data in the body of reports varies from indicated values.
  - 14. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, 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.
- E. 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 outside, supply, return, and exhaust airflows.
  2. Water flow rates.
  3. Terminal units.
  4. Balancing stations.
- F. Fan Test Reports: For exhaust fans, include the following:
  1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Sheave dimensions, center-to-center, and amount of adjustments in inches.
  2. Motor Data:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    - g. Number of belts, make, and size.
  3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
  1. Report Data:
    - a. System and air-handling unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- H. Instrument Calibration Reports:
  1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### 3.10 INSPECTIONS

- A. Initial Inspection:
  - 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
  - 2. Randomly check the following for each system:
    - a. Measure airflow of at least 10 percent of air outlets.
    - b. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    - c. Measure sound levels at two locations.
    - d. Measure space pressure of at least 10 percent of locations.
    - e. Verify that balancing devices are marked with final balance position.
    - f. Note deviations to the Contract Documents in the Final Report.
- B. Final Inspection:
  - 1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
  - 2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
  - 3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.
  - 4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
  - 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
  - 6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
  - 7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

### 3.11 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing 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 testing, inspecting, and adjusting during near-peak summer and winter conditions.

**END OF SECTION**

**SECTION 23 09 33 - TEMPERATURE CONTROLS**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 SYSTEM DESCRIPTION ..... 1  
1.05 SEQUENCE OF OPERATION ..... 1  
1.06 SUBMITTALS ..... 1  
1.07 REFERENCES ..... 2  
1.08 QUALITY ASSURANCE ..... 3  
1.09 COORDINATION ..... 3  
1.10 WARRANTY ..... 3  
PART 2 PRODUCTS ..... 3  
2.01 DAMPERS, INSULATED OUTDOOR AIR / RELIEF AIR / EXHAUST AIR - AUTOMATED ..... 3  
2.02 DAMPER OPERATORS - ELECTRIC ..... 3  
2.03 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK ..... 4  
2.04 LIMIT SWITCHES ..... 4  
2.05 LOCAL AND AUXILIARY CONTROL COMPONENT ENCLOSURE PANELS ..... 4  
2.06 THERMOSTATS – ELECTRONIC & ELECTRIC ..... 4  
PART 3 EXECUTION ..... 5  
3.01 INSTALLATION - CONTROL SYSTEMS ..... 5  
3.02 IDENTIFICATION AND MARKING ..... 5  
3.03 OWNER INSTRUCTION AND TRAINING ..... 6  
3.04 CALIBRATION AND START-UP ..... 6  
3.05 ACCEPTANCE PROCEDURE ..... 6

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 SUMMARY**

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

**1.03 DEFINITIONS**

- A. TC: Temperature Control.

**1.04 SYSTEM DESCRIPTION**

- A. Temperature control relays, switches, etc. and all associated control wiring and raceway systems.
- B. Electric thermostats, control dampers, operators, control wiring, etc.
- C. Gauges, indicating devices, electric and electronic control accessories, and other control system devices.

**1.05 SEQUENCE OF OPERATION**

- A. Control sequences for HVAC systems, subsystems, and equipment are indicated on project drawings.

**1.06 SUBMITTALS**

- A. Submit under Division 20 and 23 provisions of respective project and as supplemented in this section.
- B. All control submittal requirements shall be submitted at one time with exception to control valves, automated dampers, and initial phases of work associated with fast-track projects (when required). Early submittals of control valves and automated dampers shall be incorporated with the complete temperature controls submittal.
- C. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  - 1. Each control device labeled with setting or adjustable range of control

- D. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- E. Shop Drawings:
  - 1. Shop drawings shall be done on CAD. Minimum size 11" x 17".
  - 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  - 3. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
  - 4. Written sequence of operation for each controlled system.
  - 5. Schedule of dampers including size, leakage, and flow characteristics (Refer to Design Data).
  - 6. Complete bill of materials to identify and quantify all control components.
- F. Design Data: Provide indicated component selection and sizing criteria for the following component categories:
  - 1. Dampers:
    - a. Component tag.
    - b. Equipment served/function.
    - c. Overall damper size (inch width x inch height).
    - d. Quantity of damper sections with respective size(s):
    - e. Material and gauge of thickness.
    - f. Mounting orientation (horizontal or vertical).
    - g. Blade configuration (parallel or opposed)
    - h. Pressure drop (in. WG).
    - i. Shut-off rating/differential pressure rating (in. wg).
    - j. Leakage rating (CFM/sq.ft. at 4 in. wg).
    - k. Normal position (normally open, normally closed, floating).
    - l. Actuator spring range (where applicable).
    - m. Actuator power requirement.
    - n. Actuator torque requirement.
    - o. Actuator quantity.
    - p. Damper manufacturer/model number.
    - q. Actuator manufacturer/model number.
- G. Wall mounted thermostat and/or other temperature control device cover color shall be coordinated to match color of wall mounted electrical device components and cover plates – coordinate with electrical contractor. Provide samples of available temperature control device cover colors to Architect upon request or if available temperature control device colors do not match electrical device colors so a desired color selection may be determined. Provide sample of temperature sensor / thermostat guard upon request of Architect, Engineer or Owner.
- H. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- I. Submit field reports indicating operating conditions after detailed check out of systems at Date of Substantial Completion.
- J. Project Record Documents: Include the following:
  - 1. Revise Shop Drawings to reflect actual installation and operating sequences.
  - 2. Record actual locations of control components, including control units, thermostats, and sensors.
- K. Maintenance Manuals: Include the following:
  - 1. Product data with installation details, maintenance instructions and lists of spare parts for each type of control device.
  - 2. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  - 3. Calibration records and list of set points.

#### 1.07 REFERENCES

- A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- B. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- C. ASTM E1 - Specification for ASTM Thermometers.
- D. MMC – Michigan Mechanical Code, version applicable for project.
- E. NEMA DC 3 - Low-Voltage Room Thermostats.



### **1.08 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 all applicable code requirements for project.

### **1.09 COORDINATION**

- A. Coordinate work under Division 20 and 23 provisions and as supplemented in this section.
- B. Coordinate location of space temperature sensors, space humidity sensor, thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- C. Coordinate installation of system components with installation of mechanical systems and equipment to achieve compatibility.
- D. Ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate control wiring requirements, including actual terminal block numbers, with mechanical equipment manufacturers or suppliers.
- F. Ensure control system installation is complete, checked, tested and functioning properly prior to system balancing and Owner/Engineer system checkout.
- G. Cooperate fully with the Test and Balance Contractor and provide labor to operate the temperature control system as required to meet the scope of work defined in Division 23 Section "Testing, Adjusting and Balancing."

### **1.10 WARRANTY**

- A. Provide warranty per Division 20 Section "Mechanical General Requirements" and as supplemented in this section.

## **PART 2 PRODUCTS**

### **2.01 DAMPERS, INSULATED OUTDOOR AIR / RELIEF AIR / EXHAUST AIR - AUTOMATED**

- A. Performance: AMCA certified for Air Performance and Air Leakage.
- B. Frames: Extruded aluminum, .080-inch thickness minimum, 4 inches deep minimum, thermally broken, and insulated with polystyrene or polyurethane foam insulation.
- C. Blades: Extruded aluminum, internally insulated, and thermally broken. Maximum blade size 8 inches wide, 60 inches long.
- D. Shafts: Minimum 7/16 inch hexagonal or square corrosion resistant zinc plated steel.
- E. Blade Seals: Extruded EPDM, silicone, or synthetic elastomeric, mechanically attached.
- F. Jamb Seals: Silicone, or synthetic elastomeric, mechanically attached.
- G. Bearings: Dual bearing assembly of durable synthetic polymer resulting in no metal-to-metal contact. Provide thrust washers at bearings for all dampers which are to be mounted with blades in the vertical position.
- H. Linkage: Linkage shall be installed in the frame side and shall be constructed of aluminum and/or corrosion resistant zinc plated steel.
- I. Leakage: Less than 3 CFM per square foot at 1 inch W.G. pressure differential at minus 40 deg F.
- J. Static Pressure Rating: As scheduled on the drawings, or if not scheduled, minimum 4 inches W.G.
- K. Maximum Velocity: As scheduled on the drawings, or design for maximum velocity to be encountered in location where installed.
- L. Temperature Limits: Minus 40 to 155 deg F.
- M. Manufacturers:
  - 1. Greenheck ICD-45.
  - 2. Ruskin TED50 Series.
  - 3. Tamco Series 9000 BF.

### **2.02 DAMPER OPERATORS - ELECTRIC**

- A. Electric damper motor shall be 24 or 120 volt two-position or modulating as required with spring return type and sized to operate the damper with sufficient reserve power for smooth operation from full close to full open and tight shut-off. Damper motor shall have "O ring" gaskets for weatherproof operation.

- B. Number: Sufficient to achieve unrestricted movement throughout damper range. Provide sufficient number of operators such that one operator does not operate more than the maximum square footage of damper area as recommended in standard catalog of manufacturer.
- C. Manufacturers:
  - 1. Belimo.
  - 2. Delta Control Products.
  - 3. Honeywell.
  - 4. Schneider Electric Controls.
  - 5. Johnson Controls.
  - 6. Siemens.

### **2.03 ELECTRICAL REQUIREMENTS FOR CONTROLS WORK**

- A. Electrical accessories such as relays, switches, contactors and control transformers shall meet the requirements of the Division 26 Specifications of respective project.
- B. Electrical wiring and conduit shall meet the requirements of the Division 26 Specifications.
- C. All control wiring in mechanical rooms and any other exposed areas shall be run in conduit. Low voltage temperature control wiring in concealed accessible locations (i.e. above lay-in ceilings), as well as low voltage temperature control wiring within partitions, may be run using plenum rated cable, neatly tie-wrapped and fastened to the building structure (not to ceiling or ceiling support wires).
- D. Conduits carrying control wiring shall be sized for a maximum fill of 40% of capacity.
- E. Where raceway is required, two separate raceway systems shall be provided; one for A.C. wiring and the other for D.C. wiring.
- F. Data transmission cabling and equipment grounding procedures shall meet the latest FCC guidelines for electromagnetic field generation.
- G. All control wiring sizes and types shall meet or exceed the equipment manufacturer's recommendations.

### **2.04 LIMIT SWITCHES**

- A. Oil tight type with operator as required providing required function. Limit switches used on dampers should be set at approximately 75% of full stroke.
- B. Manufacturers:
  - 1. Allen-Bradley.
  - 2. General Electric.
  - 3. Square D.
  - 4. Westinghouse.
  - 5. Micro-switch.

### **2.05 LOCAL AND AUXILIARY CONTROL COMPONENT ENCLOSURE PANELS**

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, pushbuttons and switches flush on cabinet panel face, or as detailed on drawings. Provide panel with locking door.
- B. ANSI/NEMA 250, general purpose utility enclosures with enameled finished face panel, or as indicated on the drawings.
- C. Panels shall be sized for a maximum fill of 50% capacity, and shall not be smaller than 24" X 24".

### **2.06 THERMOSTATS – ELECTRONIC & ELECTRIC**

- A. Electronic Floating Control Room Thermostats: Microprocessor based tri-state (floating)proportional thermostat providing individual room control with setpoint adjustment, locking cover and range stops, output status LED's, night setback/setup feature with local override switch. Manufacturer: Honeywell, Model T6984 or similar.
- B. Electronic Modulating Control Room Thermostats: Microprocessor based modulating 2-10V DC thermostat providing individual room control with setpoint adjustment, locking cover and range stops, output status LED's, night setback/setup feature with local override switch. Capable of single and dual modulating outputs to meet required control application. Manufacturer: Honeywell, Model T7984 or similar.
- C. Line Voltage Room Thermostats: Adjustable single setpoint with exposed setpoint indicator and exposed thermometer for a range of 55 deg F to 85 deg F with maximum dead band of 1-1/2 degrees F, and locking cover. Contacts shall be rated for load, single-pole or two-pole as required. Provide with integral manual

On/Off/Auto selector switch where indicated on control details. Power Requirement: 24 V, ac or 120 V, ac as required.

- D. Room Thermostat Accessories:
1. Thermostat Covers: Manufacturers standard with finish as selected by Architect.
  2. Insulating Bases: Provide one inch insulating base for thermostats located on exterior walls.
  3. Adjusting Key: As required for device.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION - CONTROL SYSTEMS**

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of temperature sensors, thermostats and other exposed control sensors with plans and room details before installation. Locate room temperature sensors and thermostats 48 inches above floor unless noted otherwise.
- C. The location of all control-related items to be mounted on the exterior of the building must be approved by the Architect prior to installation. Indicate proposed locations on the shop drawings.
- D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. Sensors used for closed loop control must be connected to the same DDC controller as the associated output signal.
- E. Provide conduit and electrical wiring where required.
- F. All wiring in altered and unaltered areas shall be run concealed. "Wiremold" in finished areas shall be allowed when wiring cannot be run concealed in walls or partitions. Minimize "wiremold" routing.
- G. All equipment which has moving parts and is remotely started by the control system shall be provided with warning labels no less than 2 inches in height, and in bright warning color, stating that the equipment is remotely started by automatic controls. Such labels shall be posted clearly in the area of any moving parts, such as belts, fans, pumps, etc.
- H. Install all gauges and thermometers in locations where they are easily read from normal floor level. Provide tubing or wiring as required.
- I. Locate all control components and accessories such that they are easily accessible for adjustment, service and replacement.
- J. Locate, size and support sensing elements in airstreams so that they properly sense the representative condition. Controlling, transmitting and indicating elements shall be located to sense the average condition. Safety elements shall be located to sense the extreme condition.
- K. Locate and size sensing elements in liquid lines so that they are in moving liquid and not in stagnant or turbulent locations. Wells shall not obstruct the flow of the liquid being measured. Pipes one inch and smaller shall be increased at least one pipe size at the point of insertion.
- L. Locate, support and install all control components and accessories so that they will not be subject to vibration, excessive temperatures, dirt, moisture or other harmful conditions beyond their rated limitations.
- M. Where insulation is penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight. Provide brackets for devices to be located on insulated surfaces so as to clear the finished surface of the insulation and to avoid puncturing the vapor seal.
- N. Provide all necessary relays, switches, linkages, control devices, accessories and connections as required for a complete and operational control system as specified herein and shown.
- O. All electric valve and damper operators shall be capable of moving from full closed to full open, or vice versa, within 120 seconds.

#### **3.02 IDENTIFICATION AND MARKING**

- A. All relays, switches, etc. shall be marked with the same identification number as used on the as-built shop drawings. Use Brother P-touch label maker or similar with black text on clear or white super adhesive tape. If label applied in wet environment, spray label with clear enamel for waterproofing.
- B. Wire shall be color coded according to functional use. Identify color coding format on record drawings.
- C. Identify each wire as to ID number at each controller termination, field device termination or on the field device.

- D. All control panels and auxiliary enclosures shall be supplied with engraved phenolic nameplate permanently attached on the front exterior with panel identification to match details of temperature control submittals and include system(s) served and area(s) served on the labeling. Include labeling near 120VAC terminations within panel identifying power source panel ID and specific circuit breaker used.

### **3.03 OWNER INSTRUCTION AND TRAINING**

- A. Provide a minimum of two (2) hours of combined on-site instruction to the Owner on the operation of the control systems for the initial installation.
- B. Instruction and training shall be performed by a competent Contractor representative familiar with the control systems operation, maintenance and calibration.
- C. Training shall take place after check, test, start-up of temperature controls system at a time mutually agreed upon by the Owner and Contractor.
- D. Provide literature pertaining to the operation and maintenance of the system components provided.

### **3.04 CALIBRATION AND START-UP**

- A. After installation and connection of control components, test, adjust and re-adjust as required all control components in terms of function, design, systems balance and performance. Make systems ready for environmental equipment acceptance tests.
- B. After environmental equipment has been accepted and after the systems have operated in normal service for two weeks, check the adjustment on control components and recalibrate where required. Components not in calibration shall be recalibrated to function as required, or shall be replaced. Control devices, linkages, and other control components shall be calibrated and adjusted for stable and accurate operation in accordance with the design intent and to obtain optimum performance from the equipment controlled. Cause every device to automatically operate as intended to ensure its proper functionality.

### **3.05 ACCEPTANCE PROCEDURE**

- A. Upon successful completion of start-up and recalibration as indicated in this section, the Architect shall be requested in writing to inspect the satisfactory operation of the control systems.
- B. Demonstrate operation of all control systems, including each individual component, to the Owner and Architect.
- C. After correcting all items appearing on the punch list, make a second written request to the Owner and Architect for inspection and approval.
- D. After all items on the punch list are corrected and formal approval of the control systems is provided by the Architect, the Contractor shall indicate to the Owner in writing the commencement of the warranty period.

**END OF SECTION**

**SECTION 23 31 13 - METAL DUCTS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUMMARY ..... 1  
1.3 DEFINITIONS ..... 1  
1.4 SYSTEM DESCRIPTION ..... 1  
1.5 PERFORMANCE REQUIREMENTS ..... 2  
1.6 SUBMITTALS ..... 2  
1.7 QUALITY ASSURANCE ..... 2  
1.8 COORDINATION ..... 2  
PART 2 - PRODUCTS ..... 3  
2.1 MANUFACTURERS ..... 3  
2.2 SHEET METAL MATERIALS ..... 3  
2.3 SEALANTS AND GASKETS ..... 3  
2.4 HANGERS AND SUPPORTS ..... 4  
2.5 RECTANGULAR DUCT FABRICATION ..... 5  
2.6 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION ..... 5  
PART 3 - EXECUTION ..... 7  
3.1 DUCTWORK APPLICATION SCHEDULE ..... 7  
3.2 DUCT INSTALLATION ..... 7  
3.3 INSTALLATION OF EXPOSED DUCTWORK ..... 8  
3.4 DUCT SEALING ..... 8  
3.5 HANGING AND SUPPORTING ..... 8  
3.6 CONNECTIONS ..... 8  
3.7 PAINTING ..... 8  
3.8 FIELD QUALITY CONTROL ..... 8  
3.9 START UP ..... 9

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

**1.02 SUMMARY**

- A. This Section includes metal ducts for supply, return, outside, relief air, and exhaust air-distribution systems in pressure classes from minus 6- to plus 6-inch wg.
- B. Products Installed but Not Furnished Under This Section:
  - 1. Terminal boxes which are to be furnished by the Laboratory Airflow Controls Contractor shall be installed by the Mechanical Contractor. Refer to Division 23 Section "Laboratory Airflow Controls."

**1.03 DEFINITIONS**

- A. Duct Sizes: Inside clear dimensions. For lined ducts, maintain sizes inside lining.
- B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.
- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.
- D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.
- E. FRP: Fiberglass-reinforced plastic.
- F. PVC: Polyvinyl Chloride.

**1.04 SYSTEM DESCRIPTION**

- A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be

specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

#### **1.05 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 Application Schedule" Article.

#### **1.06 SUBMITTALS**

- A. Shop Drawings: Drawn to 1/4 inch equals 1 foot scale. Show fabrication and installation details for metal ducts. Shop drawings shall be reviewed and approved by the Architect prior to any fabrication.
1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  2. Duct layout indicating sizes and pressure classes.
  3. Elevations of top and bottom of ducts.
  4. Dimensions of main duct runs from building grid lines.
  5. Fittings.
  6. Reinforcement and spacing.
  7. Seam and joint construction.
  8. Penetrations through fire-rated and other partitions.
  9. Equipment installation based on equipment being used on Project.
  10. Duct accessories, including access doors and panels.
  11. Hangers and supports, including methods for duct and building attachment, vibration isolation.
- B. 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.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
1. Ceiling suspension assembly members.
  2. Other systems installed in same space as ducts.
  3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
  4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Welding certificates.
- E. Field quality-control test reports.

#### **1.07 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. NFPA Compliance:
1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- C. Comply with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations," Ch. 3, "Duct System," for range hood ducts, unless otherwise indicated.

#### **1.08 COORDINATION**

- A. Sheet metal trades shall cooperate fully with the Laboratory Airflow Controls Trades and shall attend all field installation training sessions.
- B. Sheet metal trades shall cooperate fully with the Test and Balance Contractor and provide all miscellaneous caps and any other materials required for structural integrity and leakage testing of the complete duct system in whole or in part. Refer to Division 23 Section "Testing, Adjusting and Balancing."

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
- C. Sheet metal trades shall participate in the above ceiling coordination program. Refer to Division 01 requirements.

## **PART 2 PRODUCTS**

### **2.01 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.

### **2.02 SHEET METAL MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M, Type 316, and having a No. 2D finish for concealed ducts and No. 4 for exposed ducts.
- D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- F. Tie Rods: For rectangular ducts having a side dimension of 48 inches or greater. Galvanized steel, 3/8-inch minimum diameter.

### **2.03 SEALANTS 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. Elastomeric Sealant Tape: 3 inches wide; modified butyl adhesive backed.
  1. Manufacturers:
    - a. Hardcast; Foil-Grip 1402 and Foil-Grip 1402-181BFX.
- C. Water-Based Joint and Seam Sealant:
  1. Manufacturers:
    - a. Hardcast; Flex-Grip 550 and Versa-Grip 181.
    - b. Polymer Adhesives; No. 11.
    - c. United McGill.
  2. Application Method: Brush on.
  3. Solids Content: Minimum 65 percent.
  4. Shore A Hardness: Minimum 20.
  5. Water resistant.
  6. Mold and mildew resistant.
  7. VOC: Maximum 75 g/L (less water).
  8. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  9. Service: Indoor or outdoor.
  10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
  1. Manufacturers:
    - a. Hardcast; Sure-Grip 404.
    - b. United McGill.
  2. Application Method: Brush on.
  3. Base: Synthetic rubber resin.
  4. Solvent: Toluene and heptane.
  5. Solids Content: Minimum 60 percent.

6. Shore A Hardness: Minimum 60.
  7. Water resistant.
  8. Mold and mildew resistant.
  9. VOC: Maximum 395 g/L.
  10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
  11. Service: Indoor or outdoor.
  12. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.
- E. 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.
- F. Gaskets: Chloroprene elastomer, 40 durometer, 1/8 inch thick, full face, one piece vulcanized or dovetailed at joints.
- G. 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.

#### 2.04 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
1. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
  2. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  3. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."
  4. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials. Attachments for stainless steel and PVC-coated duct shall be stainless steel.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Stainless-Steel Ducts: Stainless-steel support materials.
  3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.
- E. Load Rated Cable Suspension System for Noncorrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality 7 x 7 and 7 x 19 wire rope.
    - a. Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
    - b. Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
  2. Fastener: One-piece, die-cast zinc housing with Type 302 S26 stainless steel hardened and tempered springs, and oil impregnated, sintered, hardened and tempered steel locking wedges.
  3. End Fixings: Loop, stud or toggle; or plain end suitable for wire rope beam clamp.
  4. Manufacturers:
    - a. Ductmate Industries, Inc.; Clutcher and EZ-Lock.
    - b. Duro Dyne Corp.; Dyna-Tite System.
    - c. Gripple Inc.; Hang-Fast System.
- F. Stainless Steel Load Rated Cable Suspension System for Corrosive Environments: Tested to five times the Safe Working Loads and verified by the SMACNA Testing and Research Institute.
1. Cable: Aircraft quality stainless steel 7 x 7 and 7 x 19 wire rope.
    - a. Stainless steel complying with ASTM A 492.



2. Fastener: One-piece, stainless steel housing with Type 302 S26 stainless steel hardened and tempered springs, and ceramic locking wedges.
  3. End Fixings:
    - a. Loop End: Type 316L/A4 stainless steel.
    - b. Stud or Toggle End: Type 304L/A2 stainless steel.
    - c. Plain end suitable for stainless steel wire rope beam clamp.
  4. Manufacturers:
    - a. Ductmate Industries, Inc.; Clutcher and EZ-Lock.
    - b. Duro Dyne Corp.; Dyna-Tite System.
    - c. Gripple Inc.; Hang-Fast System.
- G. Welded Supports: Structural steel shapes with zinc rich paint. Equivalent, proprietary design, rolled steel structural support systems may be used in lieu of mill rolled structural steel.

## **2.05 RECTANGULAR DUCT FABRICATION**

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
  1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
  3. Internal Tie Rod: Ducts having a side dimension of 48 inches or greater only.
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's and SMACNA guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
  1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Nexus Inc.
    - c. Ward Industries, Inc.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

## **2.06 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION**

- A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.
- B. Round and Flat-Oval, Spiral Lock-Seam Ducts:
  1. Manufacturers:
    - a. Eastern Sheet Metal (ESM).
    - b. LaPine Metal Products.
    - c. Lindab Inc.
    - d. McGill AirFlow Corporation.
    - e. SEMCO Incorporated.
    - f. SET Duct Manufacturing, Inc.
    - g. Tangent Air, Inc.
    - h. Universal Spiral Air.
- C. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.
  1. Round fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.
- D. Flat-Oval, Spiral Lock-Seam Ducts: Fabricate supply ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" or SMACNA "Industrial Duct Construction Standards" as required based on pressure class.
  1. Flat-oval fittings shall be factory fabricated welded design. Use of field fabricated fittings (welded design) shall only be permitted when factory fabricated fittings are unavailable.
- E. Duct Joints:
  1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.

2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
  3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
  4. Bolts and fasteners for galvanized steel duct shall be carbon steel, zinc coated per ASTM A153. Bolts and fasteners for stainless steel and polyvinyl chloride coated steel duct shall be stainless steel.
  5. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
    - a. Manufacturers:
      - 1) AccuDuct Mfg. Inc.
      - 2) Ductmate Industries, Inc.
      - 3) Eastern Sheet Metal (ESM).
      - 4) Lindab Inc.
      - 5) Universal Spiral Air.
  6. Flat-Oval Ducts: Prefabricated connection system consisting of two flanges and one synthetic rubber gasket.
    - a. Manufacturers:
      - 1) AccuDuct Mfg. Inc.
      - 2) Ductmate Industries, Inc.
      - 3) Eastern Sheet Metal (ESM).
      - 4) McGill AirFlow Corporation.
      - 5) SEMCO Incorporated.
      - 6) Universal Spiral Air.
- F. Low Pressure Ductwork (plus or minus 2 inches W.G. Static Pressure Class)
1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
  2. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- G. Medium and High Pressure Ductwork (For Static Pressure Class Greater than plus or minus 2 inches W.G.)
1. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible provide single thickness turning vanes.
  2. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
  3. Fabricate continuously welded medium and high pressure round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
  4. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- H. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- I. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- J. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Bend radius of die-formed, gored, and pleated elbows shall be 1-1/2 times duct diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
  2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
    - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
    - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
    - c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
    - d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
  3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:

- a. Ducts 3 to 26 Inches in Diameter: 0.034 inch.
- b. Ducts 27 to 50 Inches in Diameter: 0.040 inch.
- c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
- d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.
4. Flat-Oval Mitered Elbows: Welded construction with same metal thickness as longitudinal-seam flat-oval duct.
5. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
6. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
7. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
8. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
9. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
10. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
11. Flat-Oval Elbow Metal Thickness: Same as longitudinal-seam flat-oval duct specified above.
12. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

### **PART 3 EXECUTION**

#### **3.01 DUCTWORK APPLICATION SCHEDULE**

- A. Ductwork materials and performance requirements are scheduled on the Drawing.

#### **3.02 DUCT INSTALLATION**

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.
- C. Install ducts with fewest possible joints.
- D. Install fabricated fittings for changes in directions, size, and shape and for connections.
- E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- 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. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, and sleeves. Fire and smoke dampers are specified in Division 23 Section "Duct Accessories."

- O. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.
- P. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
  - 1. Intermediate level.

### **3.03 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.

### **3.04 DUCT SEALING**

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated. Ducts must be properly cleaned and sealed in strict accordance with sealant manufacturer's instructions.
  - 1. Seal Class: Refer to Application Schedule on the Drawings.
  - 2. Seal ducts before external insulation is applied.
  - 3. After pressure testing, remake leaking joints until leakage is equal to or less than maximum allowable. Refer to Application Schedule on the Drawings for allowable leakage rates.

### **3.05 HANGING AND SUPPORTING**

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install concrete inserts before placing concrete.
- D. Support ductwork from building structure, not from roof deck, floor slab, pipe, other ducts, or equipment.
- E. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- F. Use load rated cable suspension system for round duct in exposed locations.

### **3.06 CONNECTIONS**

- A. Make connections to equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### **3.07 PAINTING**

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

### **3.08 FIELD QUALITY CONTROL**

- A. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
- B. Duct system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

**3.09 START UP**

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing."

**END OF SECTION**

This page intentionally left blank

**SECTION 23 33 00 - DUCT ACCESSORIES**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 2  
1.5 EXTRA MATERIALS ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 MANUFACTURERS ..... 2  
2.2 SHEET METAL MATERIALS ..... 2  
2.3 LOW PRESSURE MANUAL VOLUME DAMPERS ..... 2  
2.4 DAMPERS, INSULATED EXHAUST AIR - AUTOMATED ..... 3  
2.5 TURNING VANES ..... 4  
2.6 REMOTE DAMPER OPERATORS ..... 4  
2.7 DUCT-MOUNTING ACCESS DOORS ..... 4  
2.8 DUCT ACCESS PANEL ASSEMBLIES ..... 5  
2.9 FLEXIBLE CONNECTORS ..... 5  
2.10 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE ..... 5  
2.11 FLEXIBLE DUCT ELBOW SUPPORTS ..... 6  
2.12 DUCT ACCESSORY HARDWARE ..... 6  
PART 3 - EXECUTION ..... 6  
3.1 APPLICATION AND INSTALLATION ..... 6  
3.2 FIELD QUALITY CONTROL ..... 7  
3.3 ADJUSTING ..... 7

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Testing, Adjusting, and Balancing" for duct test holes.
  - 3. Division 23 Section "Temperature Controls" for motorized control dampers.
  - 4. Division 28 Section "Fire Alarm" for duct-mounting fire and smoke detectors.

**1.02 DEFINITIONS**

- A. NVLAP: National Voluntary Laboratory Accreditation Program.
- B. Low Pressure: Up to 2 inch WG and velocities less than 1,500 fpm. Construct for 2 inch WG positive or negative static pressure.
- C. Medium Pressure: Greater than 2 inch WG to 6 inch WG and velocities greater than 1,500 fpm and less than 2,500 fpm. Construct for 6 inch WG positive or negative static pressure.
- D. High Pressure: Greater than 6 inch WG to 12 inch WG and velocities greater than 2,500 fpm. Construct for 12 inch WG positive or negative static pressure.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. For turning vanes, include data for pressure loss generated sound power levels.
  - 2. For duct silencers, include pressure drop and dynamic insertion loss data.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Control damper installations.

- d. Fire-damper, smoke-damper, combination fire- and smoke-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
- e. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.
- D. Source quality-control reports.
- E. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

#### **1.04 QUALITY ASSURANCE**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

#### **1.05 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed for each temperature rating.

### **PART 2 PRODUCTS**

#### **2.01 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.

#### **2.02 SHEET METAL MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M, Types 304 and 316 as indicated.
- D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- H. Tie Rods: Stainless steel, 1/4-inch diameter for lengths 36 inches or less; 3/8-inch diameter for lengths longer than 36 inches for use in ducts in humid or corrosive atmospheres.
- I. Bird Screens: No. 2 mesh, 0.063 inch diameter galvanized wire screen with open area of not less than 72 percent. Conceal sharp edges by adding metal edging consisting of rod, flat or angle iron, or 16 gage galvanized sheet steel turned over at least 3/4 inch on both sides.

#### **2.03 LOW PRESSURE MANUAL VOLUME DAMPERS**

- A. Manufacturers:
  - 1. American Warming and Ventilating.
  - 2. Arrow United Industries.
  - 3. Greenheck.
  - 4. Krueger.
  - 5. Louvers and Dampers.
  - 6. Nailor Industries Inc.
  - 7. Ruskin Company.



8. Vent Products Company, Inc.
  9. Young Regulator Company.
- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Except for dampers in round ductwork sized 12 inches and smaller, provide end bearings.
- C. Rectangular Volume Dampers: Multiple-opposed-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- D. Round Volume Dampers 16-inch Diameter and Smaller: Single-blade design, AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- E. Round Volume Dampers Larger than 16-inch Diameter: Multiple-opposed-blade design AMCA certified for maximum leakage of 2 percent of total fan volume at shutoff, and suitable for horizontal or vertical applications.
- F. Damper Materials:
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
  3. Blade Axles: Galvanized steel.
  4. Bearings: Oil-impregnated bronze, molded synthetic, or stainless-steel sleeve type.
  5. Tie Bars and Brackets: Galvanized steel.
- G. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- H. Damper Hardware: 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. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

#### **2.04 DAMPERS, INSULATED EXHAUST AIR - AUTOMATED**

- A. Performance: AMCA certified for Air Performance and Air Leakage.
- B. Frames: Extruded aluminum, .080-inch thickness minimum, 4 inches deep minimum, thermally broken, and insulated with polystyrene or polyurethane foam insulation.
- C. Blades: Extruded aluminum, internally insulated, and thermally broken. Maximum blade size 8 inches wide, 60 inches long.
- D. Shafts: Minimum 7/16 inch hexagonal or square corrosion resistant zinc plated steel.
- E. Blade Seals: Extruded EPDM, silicone, or synthetic elastomeric, mechanically attached.
- F. Jamb Seals: Silicone, or synthetic elastomeric, mechanically attached.
- G. Bearings: Dual bearing assembly of durable synthetic polymer resulting in no metal-to-metal contact. Provide thrust washers at bearings for all dampers which are to be mounted with blades in the vertical position.
- H. Linkage: Linkage shall be installed in the frame side and shall be constructed of aluminum and/or corrosion resistant zinc plated steel.
- I. Leakage: Less than 3 CFM per square foot at 1 inch W.G. pressure differential at minus 40 deg F.
- J. Static Pressure Rating: As scheduled on the drawings, or if not scheduled, minimum 4 inches W.G.
- K. Maximum Velocity: As scheduled on the drawings, or design for maximum velocity to be encountered in location where installed.
- L. Temperature Limits: Minus 40 to 155 deg F.
- M. Manufacturers:
1. Greenheck ICD-45.
  2. Ruskin CDTI-50BF.
  3. Tamco Series 9000 BF.

## 2.05 TURNING VANES

- A. Manufactured Turning Vanes:
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
  - 2. Double-vane or airfoil-shaped, curved blades of galvanized sheet steel set into vane runners suitable for duct mounting.
  - 3. Generated sound power level shall not exceed 54 decibels in octave band 4 at 2000 fpm in a 24-inch by 24-inch duct.
  - 4. Manufacturers:
    - a. Aero/Dyne Company; H-E-P Turning Vanes.
    - b. Ductmate Industries, Inc.
    - c. Duro Dyne Corp.
    - d. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Manufactured Acoustic Turning Vanes:
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
  - 2. Double-vane curved blades of galvanized sheet steel with perforated faces and fibrous-glass fill set into vane runners suitable for duct mounting.
  - 3. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

## 2.06 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Pottorff; a division of PCI Industries, Inc.
  - 2. Ventfabrics, Inc.
  - 3. Young Regulator Company.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Brass.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Surface.
- F. Wall-Box Cover-Plate Material: Steel.

## 2.07 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class. Doors may be field fabricated in accordance with SMACNA Standards, or commercially produced.
- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
  - 1. Manufacturers:
    - a. Air Balance, Inc.
    - b. Greenheck.
    - c. Nailor Industries Inc.
    - d. Ruskin Company.
  - 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  - 3. Provide number of hinges and locks as follows:
    - a. Less Than 12 Inches Square: Secure with two sash locks.
    - b. Up to 18 Inches Square: Two hinges and two compression locks.
    - c. Up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    - d. Sizes 24 by 48 Inches and Larger: One additional hinge.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Flexmaster U.S.A., Inc.
  - 2. Frame: Galvanized sheet steel, with spin-in notched frame.

- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

## **2.08 DUCT ACCESS PANEL ASSEMBLIES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ductmate Industries, Inc.
  - 2. Flame Gard, Inc.
  - 3. 3M.
- B. Labeled according to UL 1978 by an NRTL.
- C. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.
- D. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- F. Minimum Pressure Rating: 10-inch wg, positive or negative.

## **2.09 FLEXIBLE CONNECTORS**

- A. Manufacturers:
  - 1. ADSCO Manufacturing LLC.
  - 2. Duro Dyne Corp.
  - 3. Senior Flexonics Pathway.
  - 4. Ventfabrics, Inc.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  - 1. Minimum Weight: 26 oz./sq. yd.
  - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  - 3. Service Temperature: Minus 40 to plus 200 deg F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
  - 1. Minimum Weight: 24 oz./sq. yd.
  - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
  - 3. Service Temperature: Minus 50 to plus 250 deg F.
- F. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
  - 1. Minimum Weight: 16 oz./sq. yd.
  - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
  - 3. Service Temperature: Minus 67 to plus 500 deg F.
- G. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
  - 1. Minimum Weight: 14 oz./sq. yd.
  - 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
  - 3. Service Temperature: Minus 67 to plus 500 deg F.

## **2.10 FLEXIBLE DUCTS, LOW AND MEDIUM PRESSURE**

- A. Manufacturers:
  - 1. Flexmaster Type 8M, UL 181, Class 1.
  - 2. Automation Industries Thermaflex.
  - 3. Hart & Cooley.
- B. Flexible Ducts: Interlocking spiral of galvanized steel or aluminum construction or fabric supported by helically wound spring steel wire or flat steel bands; rated to 6 inches WG positive and 4 inches WG negative for low and medium pressure ducts.
- C. Insulated Flexible Ducts: Flexible duct wrapped with flexible glass fiber insulation, enclosed by a fire retardant polyethylene vapor barrier jacket; maximum 0.23 K value at 75 deg F.

- D. Acoustical performance tested in accordance with the Air Diffusion Council's *Flexible Air Duct Test Code FD 72-R1, Section 3.0, Sound Properties* shall be as follows:

The insertion loss (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	8	32	38	35	39	25
8" diameter	13	32	36	35	36	21
12" diameter	15	29	28	33	26	14

The radiated noise reduction (dB) of a 10 foot length of straight duct when tested in accordance with ASTM E477, at a velocity of 2500 feet per minute, shall be minimum:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	6	8	7	8	9	13
8" diameter	9	6	6	7	8	10
12" diameter	9	7	6	6	8	11

The self-generated sound power levels (LW) dB are 10-12 Watt of a 10 foot length of straight duct for an empty sheet metal duct when tested in accordance with ASTM E477, at a velocity of 1000 feet per minute, shall not exceed:

Octave Band	2	3	4	5	6	7
Hz.	125	250	500	1000	2000	4000
6" diameter	42	31	23	18	17	21
8" diameter	41	34	27	19	18	21
12" diameter	53	44	36	27	21	22

- E. Flexible Duct Fittings: Galvanized steel, twist-in design with damper. Size as indicated.  
 F. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

**2.11 FLEXIBLE DUCT ELBOW SUPPORTS**

- A. Manufacturer:  
 1. Automation Industries Thermaflex; FlexFlow Elbow.  
 2. Smart Air & Energy Solutions; SMART Flow Elbow.  
 B. Elbow supports shall be constructed of durable composite material and be fully adjustable to support flexible duct diameters 6 inches through 16 inches.  
 C. Elbow supports shall be UL listed for use in return air plenum spaces.

**2.12 DUCT ACCESSORY HARDWARE**

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

**PART 3 EXECUTION**

**3.01 APPLICATION AND INSTALLATION**

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.  
 B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts and PVC coated ducts; and aluminum accessories in aluminum ducts.  
 C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.  
 D. Install volume dampers in ducts with liner in a manner that avoids damage to and erosion of duct liner.

- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  - 1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
  - 2. Control devices requiring inspection.
  - 3. Elsewhere as indicated.
- G. Install access doors with swing against duct static pressure.
- H. Install duct-mounting, rectangular access doors with long dimension at right angles to direction of airflow and of largest standard size which can be accommodated in duct. Maximum size: 21 by 14 inches.
- I. Install pressure relief doors vertically and level in accordance with manufacturer's instructions, between the fan and first operable damper.
- J. Label access doors according to Division 20 Section "Mechanical Identification."
- K. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- L. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- M. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- N. Connect flexible ducts to metal ducts with draw bands.
- O. Install flexible duct elbow supports at each diffuser, grille, or register, and elsewhere as indicated.
- P. Install turning vanes in rectangular duct elbows in excess of 45 degrees, and where indicated:
  - 1. Use manufactured double-vane turning vanes unless otherwise specified.
  - 2. Seat outboard-most vane in heel of duct elbow.
  - 3. Provide vanes for all runner punchings; practice of eliminating every other vane is prohibited.
  - 4. Use single-vane turning vanes in low pressure square elbows.

### **3.02 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. Inspect turning vanes for proper and secure installation.
  - 4. Operate remote damper operators to verify full range of movement of operator and damper.

### **3.03 ADJUSTING**

- A. Adjust duct accessories for proper settings.
- B. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

**END OF SECTION**

This page intentionally left blank

**SECTION 23 34 23 - POWER VENTILATORS**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 PERFORMANCE REQUIREMENTS ..... 1  
1.03 SUBMITTALS ..... 1  
1.04 QUALITY ASSURANCE ..... 2  
1.05 DELIVERY, STORAGE, AND HANDLING ..... 2  
1.06 COORDINATION ..... 2  
1.07 EXTRA MATERIALS ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 INLINE VENTILATORS ..... 2  
2.02 MOTORS ..... 3  
2.03 SOURCE QUALITY CONTROL ..... 3  
PART 3 EXECUTION ..... 3  
3.01 INSTALLATION ..... 3  
3.02 CONNECTIONS ..... 3  
3.03 FIELD QUALITY CONTROL ..... 3  
3.04 ADJUSTING ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Motors."
  - 3. Division 23 Section "Common Work Results for HVAC" for common mechanical drive requirements for fans and air moving equipment.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Classify according to AMCA 99.

**1.03 SUBMITTALS**

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Roof curbs.
  - 7. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
  - 2. Design Calculations: Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Coordination Drawings: Reflected ceiling plans 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. Roof framing and support members relative to duct penetrations.
  - 2. Ceiling suspension assembly members.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in operation and maintenance manuals.

#### **1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver fans as factory-assembled units, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

#### **1.06 COORDINATION**

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- C. Coordinate delivery and placement of roof curbs, and equipment supports. Installation of roof curbs, equipment supports, and roof penetrations is specified in Division 07 Section "Roof Accessories."

#### **1.07 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. Belts: One set for each belt-drive unit.

### **PART 2 PRODUCTS**

#### **2.01 INLINE CENTRIFUGAL FANS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acme Engineering & Manufacturing; Acme Fan Group;
  - 2. Aerovent; a Twin City Fan Company.
  - 3. Greenheck Fan Corporation; Models SQ/BSQ.
  - 4. Loren Cook Company;
  - 5. Moffitt Corporation.
  - 6. PennBarry; Division of Air System Components; Domex.
- B. Description: In-line, direct- or belt-driven centrifugal fans consisting of housing, wheel, guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Casing: Rectangular or cylindrical, flanged.
- D. Throat and Mounting Assembly: One-piece spun aluminum or continuously welded assembly.
  - 1. Stiffeners: Continuously welded.
  - 2. Bolts, nuts, rivets, and washers: Cadmium plated.
  - 3. Nuts: Self-locking type, vibration proof.
- E. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.
- F. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- G. Fan Wheels: Aluminum, backward curved airfoil blades welded to aluminum hub.
- H. Accessories:
  - 1. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
  - 2. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.



- I. Capacities and Characteristics: Refer to schedule(s) on Drawings.
- J. Vibration Isolators: Refer to Division 20 Section "Mechanical Vibration Controls."
- K. Spark Arrestance Class: A.

## **2.02 MOTORS**

- A. Comply with requirements in Division 20 Section "Motors."

## **2.03 SOURCE QUALITY CONTROL**

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install power ventilators level and plumb.
- B. Install floor-mounting units as specified in Division 20 Section "Mechanical Vibration Controls."
- C. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Division 20 Section "Mechanical Vibration Controls."
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 20 Section "Mechanical Identification."

### **3.02 CONNECTIONS**

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.03 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 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.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**3.04 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor sheaves as required to achieve design airflow.
- E. Lubricate bearings.

**END OF SECTION**

**SECTION 23 34 33 - AIR CURTAINS AND DOOR HEATERS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 ACTION SUBMITTALS ..... 1  
1.3 INFORMATIONAL SUBMITTALS ..... 1  
1.4 CLOSEOUT SUBMITTALS ..... 1  
1.5 QUALITY ASSURANCE ..... 1  
1.6 COORDINATION ..... 2  
1.7 EXTRA MATERIALS ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 AIR CURTAINS (UNHEATED) ..... 2  
2.2 FILTERS ..... 2  
2.3 ACCESSORIES ..... 2  
PART 3 - EXECUTION ..... 2  
3.1 EXAMINATION ..... 2  
3.2 INSTALLATION ..... 3  
3.3 CONNECTIONS ..... 3  
3.4 FIELD QUALITY CONTROL ..... 3  
3.5 ADJUSTING ..... 3  
3.6 DEMONSTRATION ..... 3

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 ACTION SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each unit.

**1.03 INFORMATIONAL SUBMITTALS**

- A. Shop Drawings: reviewed by engineers
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators
  - 2. Include plans, elevations, sections, details, and attachments to other work.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
- B. Coordination Drawings: Plans and details drawn to scale and coordinating penetrations of exterior walls.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

**1.04 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For air curtains to include in operation and maintenance manuals.
- B. Warranties: Special warranties specified in this Section.

**1.05 QUALITY ASSURANCE**

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air curtains and are based on the specific product indicated. Refer to Division 01 Section "Product Requirements."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating."
- D. Comply with AMCA 220, "Test Methods for Air Curtain Units," for airflow, outlet velocity, and power consumption.
- E. Comply with AMCA 300, "Reverberant Room Method for Sound Testing of Fans."
- F. Comply with AHRI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils," for components, construction, and rating.
  - 1. Certify coils according to AHRI 410.

- G. Comply with NSF 37, "Air Curtains for Entranceways in Food and Food Service Establishments."

#### **1.06 COORDINATION**

- A. Coordinate layout and installation of air curtains and suspension system components with other construction, including light fixtures, fire-suppression-system components, and partition assemblies.
- B. Coordinate installation of wall penetrations and louvers. These items are specified in Division 08 Section "Louvers and Vents."

#### **1.07 EXTRA MATERIALS**

- A. Furnish extra materials described below, before construction begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Furnish one set of filters and fan belts for each unit.

### **PART 2 PRODUCTS**

#### **2.01 AIR CURTAINS (UNHEATED)**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Applied Air; a Mestek Company; King Air Curtains.
  2. Berner International Corp.
  3. Mars Air Systems.
- B. Housing Materials: Minimum 14-gage, electroplated-zinc steel with welded construction and polyester-coated finish.
- C. Mounting Brackets: Steel, for ceiling mounting.
- D. Intake Louvers: Integral part of the housing, mechanically field adjustable and capable of reducing air-outlet velocity by 60 percent with louver in totally closed position.
- E. Discharge Nozzle: Integral part of the housing, containing adjustable air-directional vanes with 40 -degree sweep front to back.
- F. Fans: Painted steel, centrifugal, forward curved, double width, double inlet; statically and dynamically balanced.
- G. Fan Drives: Belt, equipped with belt guards and adjustable sheaves and pulleys for adjusting air-outlet velocity.
- H. Motor Type: Resiliently mounted, continuous duty, totally enclosed, air over, with integral thermal-overload protection.
1. Bearings: Permanently sealed, lifetime, prelubricated, ball bearings.
  2. Disconnect: Internal power cord with plug and receptacle.

#### **2.02 FILTERS**

- A. Disposable Panel Filters: Factory-fabricated, viscous-coated, flat-panel-type, disposable air filters with glass-fiber media sprayed with nonflammable adhesive in cardboard frame.
- B. Washable Panel Filters: Removable, stainless-steel, baffle-type filters with spring-loaded fastening; with minimum 0.0781-inch- thick, stainless-steel filter frame.
- C. Mounting Frames: Welded, galvanized steel with gaskets and fasteners and suitable for bolting together into built-up filter banks.

#### **2.03 ACCESSORIES**

- A. Automatic Door Switch: Plunger type installed in door area to activate air curtain when door opens and to deactivate air curtain when door closes.
- B. Time-Delay Relay: Factory installed and adjustable to allow air curtain to operate from 0.5 seconds to 10 hours.
- C. Motor-Control Panel: Complete with motor starter, 115-V ac transformer with primary and secondary fuses, terminal strip, and NEMA 250, Type 1 or 12 enclosure.
- D. Mounting Brackets: Adjustable mounting brackets for drum-type roll-up doors.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine areas and conditions where air curtains will be installed for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Examine roughing-in for install of unit.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.02 INSTALLATION**

- A. Install air curtains with clearance for equipment service and maintenance.

**3.03 CONNECTIONS**

- A. Piping installation requirements are specified in other Division 20 and 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to air curtain to allow service and maintenance.
- C. Breaching: Comply with applicable requirements in Division 23 Section, "Breechings, Chimneys, and Stacks." Connect breaching to full size at flue outlet.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding."
- E. Connect wiring according to Division 26 Section "Conductors and Cables."

**3.04 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing air curtains completely, perform visual and mechanical check of individual components.
  - 2. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation. Certify compliance with test parameters.
  - 3. Test gas train and verify that there are no gas leaks.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Repair or replace malfunctioning units and retest as specified above.

**3.05 ADJUSTING**

- A. Adjust belt tension.
- B. Adjust motor and fan speed to achieve specified airflow.
- C. Adjust discharge louver and dampers to regulate airflow.
- D. Adjust air-directional vanes.

**3.06 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air curtains.

**END OF SECTION**

This page intentionally left blank

**SECTION 23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUBMITTALS ..... 1  
PART 2 - PRODUCTS ..... 1  
2.1 AIR DIFFUSION DEVICES ..... 1  
2.2 SOURCE QUALITY CONTROL ..... 1  
PART 3 - EXECUTION ..... 2  
3.1 EXAMINATION ..... 2  
3.2 INSTALLATION ..... 2  
3.3 ADJUSTING ..... 2

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
  - 2. Division 20 Section "Mechanical General Requirements."
  - 3. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

**1.02 SUBMITTALS**

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

**PART 2 PRODUCTS**

**2.01 AIR DIFFUSION DEVICES**

- A. Manufacturers: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Anemostat; a Mestek Company.
  - 2. Krueger; Tomkins PLC.
  - 3. Nailor Industries of Texas Inc.
  - 4. Price Industries.
  - 5. Titus; Tomkins PLC.
  - 6. Tuttle & Bailey; Tomkins PLC.
- B. Terminal air diffusion devices have been chosen in terms of specific air distribution requirements, spacing, and sound characteristics.
- C. Provide plaster frames for units installed in plaster ceilings.
- D. Provide gaskets for supply terminal air devices mounted in finished surfaces.
- E. Air diffusion devices shall be standard off white baked enamel finish unless noted otherwise. Provide air diffusion device interior surfaces, including blank-offs, with black matte finish.
- F. Air pattern adjustments shall be made from the face of the device.
- G. Refer to drawings and schedules for quantities, types, and finishes.
- H. Coordinate frame types with Architectural Reflected Ceiling Plan.

**2.02 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."
- B. Acoustical Applications and Sound Evaluation: Based on ARI Standard 885-98, "Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets."

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 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 practicable. 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. Wall-Mounted Supply Registers: Install 6 inches below finished ceiling unless otherwise indicated.
- D. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

#### **3.03 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 37 23 – AIR INTAKE AND RELIEF HOODS**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 PERFORMANCE REQUIREMENTS ..... 1  
1.03 SUBMITTALS ..... 1  
1.04 QUALITY ASSURANCE ..... 1  
1.05 COORDINATION ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 MANUFACTURERS ..... 2  
2.02 MATERIALS ..... 2  
2.03 FABRICATION, GENERAL ..... 2  
2.04 GRAVITY INTAKE AND RELIEF HOODS (RECTANGULAR) ..... 2  
2.05 ACCESSORIES ..... 2  
PART 3 EXECUTION ..... 3  
3.01 INSTALLATION ..... 3  
3.02 CONNECTIONS ..... 4  
3.03 ADJUSTING ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 23 Section "Power Ventilators" for roof-mounting exhaust fans.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Intake and relief ventilators shall be capable of withstanding the effects of gravity loads, wind loads, and thermal movements without permanent deformation of components, noise or metal fatigue, or permanent damage to fasteners and anchors.

**1.03 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For intake and relief ventilators. Include plans, elevations, sections, details, and ventilator attachments to curbs and curb attachments to roof structure.
- C. Coordination Drawings: Roof framing plans 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. Structural members to which roof curbs and ventilators will be attached.
  - 2. Sizes and locations of roof openings.
- D. Samples for Verification: For each type of exposed finish required for intake and relief ventilators.
- E. Welding certificates.

**1.04 QUALITY ASSURANCE**

- A. Source Limitations: Obtain ventilators through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of intake and relief ventilators and are based on the specific equipment indicated. Refer to Division 01 Section "Product Requirements."
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.2, "Structural Welding Code--Aluminum."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

#### **1.05 COORDINATION**

- A. Coordinate installation of roof curbs and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

### **PART 2 PRODUCTS**

#### **2.01 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.

#### **2.02 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 Phillips flat, 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.

#### **2.03 FABRICATION, GENERAL**

- A. Factory or shop fabricate intake and relief ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

#### **2.04 GRAVITY INTAKE AND RELIEF HOODS (RECTANGULAR)**

- A. Manufacturers:
  1. Acme Engineering & Mfg. Corp.
  2. Greenheck; Fabra-Hood.
  3. Loren Cook Company.
  4. Moffitt Corporation, Inc.
  5. Penn Ventilation.
- B. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figures 5-6 and 5-7.
- C. Materials: Aluminum sheet, minimum 0.063-inch- thick base and 0.050-inch- thick hood; suitably reinforced.
- D. Bird Screening: Aluminum, 1/2-inch- square mesh, 0.063-inch wire.

#### **2.05 ACCESSORIES**

- A. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch-chemically treated wood nailer. Size as required to suit roof opening and hood base.

1. Manufacturers: Roof curbs shall be provided by the hood manufacturer, or one of the following:
    - a. Creative Metals.
    - b. Pate.
    - c. Roof Products & Systems.
    - d. ThyCurb.
    - e. Any of the listed hood manufacturers.
  2. Configuration: Self-flashing without a cant strip, with mounting flange, and suitable for flat roofs with tapered insulation.
  3. Height: Curb shall extend a minimum 18 inches above top surface of roof insulation.
  4. Metal Liner: Galvanized steel.
  5. Burglar Bars: Minimum 1/2-inch- thick steel bars welded in place to form 6-inch squares.
- B. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch chemically treated wood nailer. Size as required to suit roof opening and hood base.
1. Manufacturers: Roof curbs shall be provided by the hood manufacturer, or one of the following:
    - a. Creative Metals.
    - b. Pate.
    - c. Roof Products & Systems.
    - d. ThyCurb.
    - e. Any of the listed hood manufacturers.
  2. Configuration: Built-in raised cant with step dimension matching insulation thickness, with mounting flange, and suitable for sloped roofs with uniform insulation thickness.
  3. Height: Curb shall extend a minimum 18 inches above top surface of roof insulation.
  4. Pitch Mounting: Manufacture curb for roof slope, top of curb shall be level.
  5. Metal Liner: Galvanized steel.
  6. Burglar Bars: Minimum 1/2-inch- thick steel bars welded in place to form 6-inch squares.
- C. Roof Curb Extensions and Adapters:
1. Manufacturers: Roof curbs shall be provided by the fan manufacturer, or one of the following:
    - a. Creative Metals.
    - b. Pate.
    - c. Roof Products & Systems.
    - d. ThyCurb.
    - e. Any of the listed hood manufacturers.
  2. Curb Extensions: Constructed of minimum 18 gage galvanized steel.
    - a. 12-inch high construction with damper shelf; and removable panel, or access door (minimum required for motorized damper).
  3. Curb Adapters: Constructed of minimum 18 gage galvanized steel and designed to adapt or reduce curb cap dimensions to match new hoods to existing roof curbs.
- D. Motorized Backdraft Damper: Refer to DAMPERS – AUTOMATED in Division 23 Section "Temperature Controls."

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install intake and relief hoods level, plumb, and at indicated alignment with adjacent work.
- B. Secure intake and relief hoods to roof curbs with cadmium-plated hardware. Use concealed anchorages where possible.
- C. Install goosenecks on curb base where throat size exceeds 9 by 9 inches.
- D. Install intake and relief hoods with clearances for service and maintenance.
- E. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Division 07 Section "Joint Sealants" for sealants applied during installation.
- G. Label intake and relief hoods according to requirements specified in Division 20 Section "Mechanical Identification."
- H. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

- I. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

### **3.02 CONNECTIONS**

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories.

### **3.03 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.

**END OF SECTION**

**SECTION 23 82 29 - ELECTRIC RADIANT HEATING UNITS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 DEFINITIONS ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
1.5 COORDINATION ..... 1  
PART 2 - PRODUCTS ..... 2  
2.1 ELECTRIC RADIANT HEATING PANELS ..... 2  
PART 3 - EXECUTION ..... 2  
3.1 EXAMINATION ..... 2  
3.2 INSTALLATION ..... 2  
3.3 CONNECTIONS ..... 3  
3.4 FIELD QUALITY CONTROL ..... 3  
3.5 DEMONSTRATION ..... 3

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 DEFINITIONS**

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits

**1.03 SUBMITTALS**

- A. Product Data: Include rated capacities, specialties, and accessories for each product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Detail equipment assemblies and suspension and attachment. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- 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. Suspended ceiling components.
  - 2. Structural members to which heaters and suspension systems will be attached.
  - 3. Size and location of initial access modules for acoustical tile.
  - 4. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
  - 5. Perimeter moldings.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For electric radiant heaters and panels to include in operation and maintenance manuals.

**1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a NRTL acceptable to authorities having jurisdiction, and marked for intended use.

**1.05 COORDINATION**

- A. Coordinate layout and installation of radiant heaters and panels and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## **PART 2 PRODUCTS**

### **2.01 ELECTRIC RADIANT HEATING PANELS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Berko Electric Heating; a division of Marley Engineered Products.
  - 2. Markel Products; a division of TPI Corporation.
  - 3. QMark Electric Heating; a division of Marley Engineered Products.
- B. Description: Sheet-metal-enclosed panel with heating element suitable for installation flush with T-bar ceiling grid recessed mounting. Comply with UL 2021.
  - 1. Panel: Minimum 0.0276-inch- thick, galvanized-steel sheet back panel riveted to minimum 0.0396-inch- thick, galvanized-steel sheet front panel with fused-on crystalline surface.
  - 2. Nominal Panel Size: 24 by 48 inches.
  - 3. Heating Element: Powdered graphite sandwiched between sheets of electric insulation.
  - 4. Electrical Connections: Nonheating, high-temperature, insulated-copper leads, factory connected to heating element.
  - 5. Exposed-Side Panel Finish: Baked-enamel finish in manufacturer's standard paint color as selected by Architect.
- C. Wall Thermostat: Bimetal, sensing elements calibrated from 55 to 90 deg F; with contacts suitable for low-voltage circuit, and manually operated on-off switch with contactors, relays, and control transformers.
- D. Capacities and Characteristics: Refer to Schedules on Drawings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas to receive radiant heating units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for electrical connections to verify actual locations before radiant heating and cooling unit installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install radiant heating units level and plumb.
- B. The linear radiant and matching non-radiant panels shall be installed by manufacturer's authorized Radiant Ceiling Contractor. Contractor shall install all panels in accordance with the manufacturer's recommendations.
- C. The installation of the radiant panel ceiling and matching non-radiant (inactive) panels shall be made by a single Radiant Ceiling Sub-Contractor experienced in this work. The subcontractor shall provide labor, materials, equipment, and supervision for a complete and operational system. Sub-Contractor shall submit certification of having a minimum of two (2) years previous experience in radiant ceiling installations.
  - 1. Contractor shall provide all necessary wall channels, angles and required support for radiant panel. Contractor shall provide tee sections between adjacent panels and at panel ends. Contractor shall verify ceiling openings are large enough to accommodate thermal expansion and contraction of ceiling panels. The ceiling contractor shall provide and install the tee between the acoustical ceiling and the radiant panel along the length of the panel.
- D. Radiant ceiling panel suspension shall be independent of the ceiling system.
- E. Hangers shall be installed as recommended by the manufacturer.
- F. Contractor shall integrate and coordinate radiant ceiling panel installation with ceiling grid installation (by others).
- G. The Radiant Ceiling Sub-Contractor shall cooperate with other trades working in the ceiling to achieve a neat, well coordinated, and properly sequenced overall installation.
- H. Work of Radiant Ceiling Sub-contractor shall terminate within three feet of the supply and return point of each panel circuit.
- I. The Radiant Ceiling Sub-Contractor shall furnish and install all necessary piping and bends required for the interconnection of the panel sections. The panel interconnecting pipe and bends shall be furnished by the panel manufacturer and shall provide for necessary expansion and contraction as recommended by the manufacturer.

- J. All installation of linear panels, where made with mitered joints, shall be made so that the fluting on the abutting panel is aligned.
- K. Verify locations of thermostats with Drawings and room details before installation. Install devices 48 inches above finished floor.

### **3.03 CONNECTIONS**

- A. Ground electric units according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.04 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field tests and inspections and prepare test reports:
  - 1. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and units.
- B. Remove and replace malfunctioning units and retest as specified above.
- C. After installing panels, inspect unit cabinet for damage to finish. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

### **3.05 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain radiant heaters and panels.

**END OF SECTION**

This page intentionally left blank



**SECTION 23 82 41 - PROPELLER FAN UNIT HEATERS – ELECTRIC**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SUMMARY ..... 1  
1.3 SUBMITTALS ..... 1  
1.4 QUALITY ASSURANCE ..... 1  
PART 2 - PRODUCTS ..... 2  
2.1 MANUFACTURERS ..... 2  
2.2 UNIT HEATERS ..... 2  
2.3 CASING ..... 2  
2.4 ELECTRIC-RESISTANCE HEATING ELEMENTS ..... 2  
2.5 FAN ..... 2  
2.6 FAN MOTORS ..... 2  
2.7 CONTROLS ..... 2  
2.8 CAPACITIES AND CHARACTERISTICS ..... 2  
PART 3 - EXECUTION ..... 3  
3.1 EXAMINATION ..... 3  
3.2 INSTALLATION ..... 3  
3.3 CONNECTIONS ..... 3  
3.4 FIELD QUALITY CONTROL ..... 3  
3.5 DEMONSTRATION ..... 3

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section “Mechanical General Requirements.”
  - 2. Division 20 Section “Basic Mechanical Materials and Methods.”

**1.02 SUMMARY**

- A. This Section includes propeller fan unit heaters with electric-resistance coils.

**1.03 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each unit type and configuration.
- B. Shop Drawings: Submit the following for each unit type and configuration:
  - 1. Plans, elevations, sections, and details.
  - 2. Details of anchorages and attachments to structure and to supported equipment.
  - 3. Wiring Diagrams: Power, signal, and control wiring.
  - 4. Equipment schedules to include rated capacities, operating characteristics, furnished specialties, and accessories.
- C. Coordination Drawings: 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. Suspended ceiling components.
  - 2. Structural members to which unit heaters will be attached.
  - 3. Other items, including the following:
    - a. Lighting fixtures.
    - b. Sprinklers.
    - c. Ductwork.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

**1.04 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.

- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Electric Unit Heaters:
    - a. Brasch Manufacturing Co.
    - b. Chromalox, Inc.; a division of Emerson Electric Company.
    - c. Electra Tek Corp.
    - d. Indeeco.
    - e. Markel Products; a division of TPI Corporation.
    - f. Sterling Radiator; a Mestek Company.
    - g. Trane Inc.; a Division of Ingersoll Rand.

### **2.02 UNIT HEATERS**

- A. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
- B. Comply with UL 2021.
- C. Comply with UL 823.

### **2.03 CASING**

- A. Cabinet: Removable panels for maintenance access to controls.
- B. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.
- C. Discharge Louver: Four-way adjustable louvers for horizontal units and adjustable pattern diffuser for projection units.

### **2.04 ELECTRIC-RESISTANCE HEATING ELEMENTS**

- A. Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.
  - 1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
  - 2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

### **2.05 FAN**

- A. Propeller type, aluminum wheel directly mounted on motor shaft in the fan venturi.

### **2.06 FAN MOTORS**

- A. Comply with requirements in Division 20 Section "Motors."
- B. Motor Type: Permanently lubricated.

### **2.07 UNIT CONTROLS**

- A. Control Devices:
  - 1. Control voltage transformer, relays, and terminals for 24v control by others.
  - 2. Wall mounted thermostat with the following features.
    - a. Heat-off switch.
    - b. Fan on-auto switch
    - c. Concealed set point.
    - d. Concealed indication.

### **2.08 CAPACITIES AND CHARACTERISTICS**

- A. Refer to Schedule on Drawings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before propeller unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 INSTALLATION**

- A. Install propeller unit heaters level and plumb.
- B. Install propeller unit heaters to comply with NFPA 90A.
- C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers.
  - 1. Hanger rods and attachments to structure are specified in Division 20 Section "Hangers and Supports."
  - 2. Vibration hangers are specified in Division 20 Section "Mechanical Vibration Controls."
- D. Install wall-mounting thermostats in electrical outlet boxes at heights to match lighting controls.

### **3.03 CONNECTIONS**

- A. Comply with safety requirements in UL 1995.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.04 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing and report results in writing:
  - 1. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 3. Test and adjust controls and safeties.
- B. Remove and replace malfunctioning units and retest as specified above.

### **3.05 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain propeller fan unit heaters. Refer to Division 20 Section "Mechanical General Requirements."

**END OF SECTION**

This page intentionally left blank

**SECTION 23 82 44 - CENTRIFUGAL FAN CABINET UNIT HEATERS (ELECTRIC)**

PART 1 - GENERAL .....	1
1.1 RELATED DOCUMENTS .....	1
1.2 SUBMITTALS .....	1
1.3 QUALITY ASSURANCE .....	1
1.4 EXTRA MATERIALS.....	1
PART 2 - PRODUCTS .....	2
2.1 MANUFACTURED UNITS .....	2
2.2 UNIT CONTROLS.....	2
PART 3 - EXECUTION .....	3
3.1 EXAMINATION .....	3
3.2 INSTALLATION .....	3
3.3 CONNECTIONS .....	3
3.4 FIELD QUALITY CONTROL.....	3
3.5 DEMONSTRATION .....	3

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 20 Section "Mechanical General Requirements."
  - 2. Division 20 Section "Basic Mechanical Materials and Methods."

**1.02 SUBMITTALS**

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Plans, elevations, sections, and details.
  - 2. Location and size of each field connection.
  - 3. Location and arrangement of integral controls.
  - 4. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, reflected ceiling plans, 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. Suspended ceiling components.
  - 2. Structural members to which cabinet unit heaters will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Size and location of initial access modules for acoustical tile.
  - 5. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Access panels.
  - 6. Perimeter moldings for exposed or partially exposed cabinets.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For cabinet unit heaters to include in operation and maintenance manuals.

**1.03 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an NRTL acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

**1.04 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. Cabinet Unit Heater Filters: Furnish spare filter for each filter installed.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURED UNITS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Berko Electric Heating; a division of Marley Engineered Products.
  2. Brasch Manufacturing Co., Inc.
  3. Chromalox, Inc.; a division of Emerson Electric Company.
  4. Indeeco.
  5. Markel Products; a division of TPI Corporation.
  6. QMark Electric Heating; a division of Marley Engineered Products.
  7. Sterling Radiator; a Mestek Company.
- B. Description: A factory-assembled and -tested unit complying with AHRI 440.
  1. Comply with UL 2021.
- A. Coil Section Insulation: ASTM C 1071; surfaces exposed to airstream shall have erosion-resistant coating to prevent erosion of glass fibers.
  1. Thickness: Minimum 1/2 inch.
  2. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
  3. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
  4. Adhesive: Comply with ASTM C 916 and with NFPA 90A or NFPA 90B.
  5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- B. Cabinet: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.
  1. Horizontal Unit, Exposed Bottom Panels: Minimum 0.0528-inch- thick, sheet steel, removable panels secured with tamperproof cam fasteners and safety chain.
  2. Vertical Unit, Exposed Front Panels: Minimum 0.0528-inch- thick, sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
  3. Recessing Flanges for Units That Are Semirecessed or Fully Recessed: Steel, finished to match cabinet.
  4. Control Access Door: Key operated.
  5. Base for Surface, Vertical, Wall-Mounting Units: Minimum 0.0528-inch- thick steel, finished to match cabinet, 6 inches high with leveling bolts.
- C. Filters: Minimum arrestance according to ASHRAE 52.1 and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
  1. Glass Fiber Treated with Adhesive: Throw-away type 80 percent arrestance and 5 MERV.
- D. Electric-Resistance Heating Coil: Non-glowing type. Steel fins brazed to high temperature resistance wire enclosed in incoloy sheath; with fuses in terminal box for overcurrent protection and limit controls for high-temperature protection. Terminate elements in stainless-steel machine-staked terminals secured with stainless-steel hardware.
- E. Fan and Motor Board: Removable.
  1. Fan: Forward curved, double-width centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
  2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 20 Section "Motors."
  3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- F. Electrical Connection: Factory wire motors and controls for a single field connection.
- G. Capacities and Characteristics: Refer to Schedule on Drawings.

### **2.02 UNIT CONTROLS**

- A. Basic Unit Controls

1. Control voltage transformer, relays, and terminals for 24v control by others.
2. Wall mounted thermostat with the following features.
  - a. Heat-off switch.
  - b. Fan on-auto switch
  - c. Concealed set point.
  - d. Concealed indication.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in for electrical connections to verify actual locations before cabinet unit heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.02 INSTALLATION**

- A. Install cabinet unit heaters to comply with NFPA 90A.
- B. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Division 20 Section "Mechanical Vibration and Controls."
- C. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- D. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

#### **3.03 CONNECTIONS**

- A. Comply with safety requirements in UL 1995.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

#### **3.04 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.

#### **3.05 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cabinet unit heaters.

**END OF SECTION**

This page intentionally left blank



**SECTION 26 00 10 - ELECTRICAL GENERAL REQUIREMENTS**

PART 1 - GENERAL ..... 1

1.1 RELATED DOCUMENTS ..... 1

1.2 SUMMARY ..... 1

1.3 REFERENCES ..... 1

1.4 QUALITY ASSURANCE ..... 2

1.5 CODES, PERMITS AND FEES ..... 2

1.6 DRAWINGS ..... 2

1.7 MATERIAL AND EQUIPMENT MANUFACTURERS ..... 2

1.8 INSPECTION OF SITE ..... 3

1.9 ITEMS REQUIRING PRIOR APPROVAL ..... 3

1.10 SHOP DRAWINGS/SUBMITTALS ..... 3

1.11 COORDINATION DRAWINGS ..... 3

1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS ..... 3

1.13 RECORD DRAWINGS ..... 4

1.14 INSTRUCTION OF OWNER PERSONNEL ..... 4

1.15 WARRANTY ..... 4

1.16 USE OF EQUIPMENT ..... 4

1.17 COORDINATION ..... 4

PART 2 - PRODUCTS (NOT APPLICABLE) ..... 5

PART 3 - EXECUTION ..... 5

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION ..... 5

3.2 DEMOLITION WORK ..... 5

3.3 INSTALLATION OF EQUIPMENT ..... 6

3.4 WORK IN EXISTING BUILDINGS ..... 6

3.5 TEMPORARY SERVICES ..... 6

3.6 DISPOSAL ..... 6

3.7 CHASES AND RECESSES ..... 6

3.8 CUTTING, PATCHING AND DAMAGE TO OTHER WORK ..... 6

3.9 EXCAVATION AND BACKFILLING ..... 7

3.10 EQUIPMENT CONNECTIONS ..... 7

3.11 CLEANING ..... 7

3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS ..... 7

3.13 EXTRA WORK ..... 7

3.14 DRAWINGS AND MEASUREMENTS ..... 7

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

**1.02 SUMMARY**

- A. This Section includes electrical general administrative and procedural requirements. The following requirements are included in this Section to supplement the requirements specified in Division 1 Specification Sections.

**1.03 REFERENCES**

- A. All materials shall be new. The electrical and physical properties of all materials, and the design, performance characteristics, and methods of construction of all items of equipment, shall be in accordance with the latest issue of the various, applicable Standard Specifications of the following recognized authorities:
  - 1. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 2. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
  - 3. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
  - 4. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
  - 5. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
  - 6. NEC - National Electrical Code
  - 7. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
    - a. NECA 1-2000, "Practices for Good Workmanship in Electrical Contracting (ANSI)."
  - 8. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
  - 9. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).

10. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).

#### **1.04 QUALITY ASSURANCE**

- A. Scope of Work: Furnish all labor, material, equipment, technical supervision, and incidental services required to complete, test, and leave ready for operation the electrical systems as specified in the Division 26 Sections and as indicated on Drawings.
  - 1. Contract Documents are complementary, and what is required by one shall be as binding as if required by all. In the event of inconsistencies or disagreements within the Construction Documents bids shall be based on the most expensive combination of quality and quantity of the work indicated.
  - 2. The Contractor understands that the work herein described shall be complete in every detail.
- B. Ordinances and Codes: Perform all Work in accordance with applicable Federal, State, and local ordinances and regulations, the Rules and Regulations of NFPA, NECA, and UL, unless otherwise indicated.
  - 1. Notify the Architect/Engineer if revisions to the Drawings or Specifications are required to conform to applicable ordinances, codes, or regulations. Identify the cost associated with these revisions in the bid.
- C. Source Limitations: All equipment of the same or similar systems shall be by the same manufacturer.
- D. Tests and Inspections: Perform all tests required by state, city, county, and/or other agencies having jurisdiction. Provide all materials, equipment, etc., and labor required for tests.
- E. Performance Requirements: Perform all work in a first class and workmanlike manner, in accordance with the latest accepted standards and practices for the trades involved.
- F. Sequence and Schedule: Avoid interference with the work of other trades. Remove and relocate any work which in the opinion of the Owner's Representatives causes interference.

#### **1.05 CODES, PERMITS AND FEES**

- A. Unless otherwise indicated, all required permits, licenses, inspections, approvals, and fees for electrical work shall be secured and paid for by the Contractor. All work shall conform to all applicable codes, rules, and regulations.
- B. Comply with rules of local utility companies. Coordinate with the utility company supplying service to the installation and determine all devices including, but not limited to, all current and potential transformers, meter boxes, C.T. cabinets, and meters which will be required and include the cost of all such items and all utilities costs in proposal.
- C. All work shall be executed in accordance with the rules and regulations outlined in local and state codes. Prepare any detailed Drawings or diagrams which may be required by the governing authorities. Where the Drawings and/or Specifications indicate materials or construction that exceed code requirements, the Drawings and/or Specifications shall govern.

#### **1.06 DRAWINGS**

- A. The Drawings show the location and general arrangement of equipment, electrical systems, and related items. They shall be followed as closely as elements of the construction will permit.
- B. Examine the Drawings of other trades and verify the conditions governing the work on the job site. Arrange work accordingly, providing such fittings, conduit, junction boxes, and accessories as may be required to meet such conditions.
- C. Deviations from the Drawings, apart from minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the systems, shall not be made without the written approval of the Architect/Engineer.
- D. The architectural and structural Drawings take precedence in all matters pertaining to the building structure, mechanical Drawings in all matters pertaining to mechanical trades, and electrical Drawings in all matters pertaining to electrical trades. Where there are conflicts or differences between the Drawings for the various trades, report such conflicts or differences to the Architect/Engineer for resolution.
- E. Drawings are not intended to be scaled for rough-in or to serve as shop drawings. Take all field measurements required to complete the Work.

#### **1.07 MATERIAL AND EQUIPMENT MANUFACTURERS**

- A. All items of equipment shall be furnished complete with all accessories normally supplied with the catalog items listed and all other accessories necessary for a complete and satisfactory operating system. All equipment and materials shall be new, be standard products of manufacturers regularly engaged in the production of electrical equipment and be of the manufacturer's latest design.

- B. If an approved manufacturer is other than the manufacturer used as the basis for design, the equipment or product provided shall be equal in size, quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall conform with arrangements and space limitations of the equipment shown on the plans and/or specified, shall be compatible with the other components of the system and shall comply with the requirements for Items Requiring Prior Approval specified in this section of the Specifications. All costs to make these items of equipment comply with these requirements including, but not limited to, electrical work, and building alterations shall be included in the original Bid. Similar equipment shall be by one manufacturer.
- C. Where existing equipment is modified to include new switches, circuit breakers, metering, or other components, the new components shall be by the original equipment manufacturer and shall be listed for installation in the existing equipment. Where original equipment manufacturer components are not available, third-party aftermarket components shall be listed for the application and submitted to the engineer for approval. Reconditioned or salvaged components shall not be used unless specifically indicated on the drawings.

#### **1.08 INSPECTION OF SITE**

- A. Visit the site, examine, and verify the conditions under which the Work must be conducted before submitting Proposal. The submitting of a Proposal implies that the Contractor has visited the site and understands the conditions under which the Work must be conducted. No additional charges will be allowed because of failure to make this examination or to include all materials and labor to complete the Work.

#### **1.09 ITEMS REQUIRING PRIOR APPROVAL**

- A. Bids shall be based upon manufactured equipment specified. All items that the Contractor proposes to use in the Work that are not specifically named in the Contract Documents must be submitted for review prior to bids. Such items must be submitted in compliance with Division 1 specifications. Requests for prior approval must be accompanied by complete catalog information, including but not limited to, model, size, accessories, complete electrical information, and performance data in the form given in the equipment schedule on the drawings at stated design conditions. Where items are referred to by symbolic designations on the drawings, all requests for prior approval shall bear the same designations.
  - 1. Equipment to be considered for prior approval shall be equal in quality, durability, appearance, capacity, and efficiency through all ranges of operation, shall fulfill the requirements of equipment arrangement and space limitations of the equipment shown on the plans and/or specified and shall be compatible with the other components of the system.
  - 2. All costs incurred to make equipment comply with other requirements, including providing maintenance, clearance, electrical, replacement of other components, and building alterations shall be included in the original bid.
- B. Voluntary alternates may be submitted for consideration, with listed addition or deduction to the bid.

#### **1.10 SHOP DRAWINGS/SUBMITTALS**

- A. Submit project-specific submittals for review in compliance with Division 1.
- B. All shop Drawings shall be submitted in groupings of similar and/or related items (lighting fixtures, switchgear, etc.). Incomplete submittal groupings will be returned unchecked.
- C. If deviations (not substitutions) from the Contract Documents are deemed necessary by the Contractor, the details of such deviations, the reason for the deviation, and the resulting changes shall be included with the submittal for approval.
- E. Submit for approval shop drawings for electrical systems or equipment indicated in other sections of electrical specs. Where items are referred to by symbolic designation on the Drawings and Specifications, all submittals shall bear the same designation (light fixtures).

#### **1.11 COORDINATION DRAWINGS**

- A. Submit project specific coordination drawings for review in compliance with Division 1 Specification Sections.

#### **1.12 OPERATION AND MAINTENANCE INSTRUCTIONAL MANUALS**

- A. Submit project specific Operation and Maintenance Instructional Manuals for review in compliance with Division 01 Specification Sections.
- B. Provide complete operation and maintenance instructional manuals covering all electrical equipment herein specified, together with parts lists. Maintenance and operating instructional manuals shall be job specific to this project. Generic manuals are not acceptable. Manual shall be provided on electronic media. All literature shall be combined in one document and shall be properly bookmarked with all applicable sections.

Maintenance and operating instructional manuals shall be provided when construction is approximately 75% complete.

- C. The operating and maintenance instructions shall include a brief, general description for all electrical systems including, but not limited to:
  - 1. Routine maintenance procedures.
  - 2. Trouble-shooting procedures.
  - 3. Contractor's telephone numbers for warranty repair service.
  - 4. Submittals.
  - 5. Recommended spare parts list.
  - 6. Names and telephone numbers of major material suppliers and subcontractors.
  - 7. System schematic drawings on 8-1/2" x 11" sheets.

### **1.13 RECORD DRAWINGS**

- A. Submit record drawings in compliance with Division 01.
- B. Contractor shall submit to the Architect/Engineer, record drawings on electronic media which have been neatly marked to represent as-built conditions for all new electrical work. Modifications to original drawings shall be marked with a contrasting color so the marks are readily apparent.
- C. The Contractor shall keep accurate note of all deviations from the construction documents and discrepancies in the underground concealed conditions and other items of construction on field drawings as they occur. The marked up field documents shall be available for review by the Architect, Engineer, and Owner at their request during construction.

### **1.14 INSTRUCTION OF OWNER PERSONNEL**

- A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of electrical equipment and systems at agreed upon times. A minimum of 8 hours of formal instruction to Owner's personnel shall be provided for each building. Additional hours are specified in individual specification sections.
- B. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- C. In addition to individual equipment training provide overview of each electrical system. Utilize the as-built documents for this overview.
- D. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction, or as requested by Owner.

### **1.15 WARRANTY**

- A. Warranty: Comply with the requirements in Division 01 Specification Sections. Contractor shall warranty that the electrical installation is free from defects and agrees to replace or repair, to the Owner's satisfaction, any part of this electrical installation which becomes defective within a period of one year (unless specified otherwise in other Division 26 sections) from the date of substantial completion following final acceptance, provided that such failure is due to defects in the equipment, material, workmanship, or failure to follow the contract documents.
- B. Contractor shall be responsible for any temporary services including equipment and installation required to maintain operation as a result of any equipment failure or defect during warranty period.
- C. File with the Owner all warranties from the equipment manufacturers including the operating conditions and performance capacities they are based on.

### **1.16 USE OF EQUIPMENT**

- A. The use of any equipment, or any part thereof for purposes other than testing even with the Owner's consent, shall not be construed to be an acceptance of the work on the part of the Owner, nor be construed to obligate the Owner in any way to accept improper work or defective materials.
- B. Do not use Owner's lamps for temporary lighting except as allowed and directed by the Owner. Equip lighting fixtures with new lamps when the project is turned over to the Owner.

### **1.17 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. To ensure that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions; and to maintain the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
  - C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."
  - D. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

## **PART 2 PRODUCTS (NOT APPLICABLE)**

## **PART 3 EXECUTION**

### **3.01 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 raceways and piping systems installed at a required slope.

### **3.02 DEMOLITION WORK**

- A. All demolition of existing electrical equipment and materials will be done by this Contractor unless otherwise indicated. Include all items related to the existing systems that are being removed such as, but not limited to, electrical equipment, cabinets, devices, lighting fixtures, conduit, fittings, boxes, wiring, and supports. No abandoned components of the electrical systems indicated to be removed shall remain.
  1. Where electrically powered equipment is included in the demolition scope of other trades, disconnect electrical wiring connections and remove circuit wiring complete.
- B. In general, demolition work is indicated on the Drawings. However, the Contractor shall visit the job site to determine the full extent and character of this work.
- C. Unless specifically noted otherwise, removed materials shall not be reused in the work.
  1. Materials indicated to be salvaged shall be carefully removed, stored, and protected from damage.
  2. Salvaged materials intended to be re-used shall be thoroughly cleaned, refurbished if necessary, and determined to be fully functional prior to placing back into service.
  3. Salvaged materials of value that are not to be reused shall remain the property of the Owner unless such ownership is waived. Items that the Owner has waived ownership shall become the property of the Contractor, who shall remove and legally dispose of same, away from the premises.
- D. Where equipment or fixtures are removed, outlet boxes that remain recessed in walls shall be properly blanked off, and conduits capped. After alterations are complete, the entire installation shall present a "finished" look, as approved by the Architect/Engineer. The original function of the present electrical systems remaining in service shall not be changed unless specifically indicated as part of the project scope.
- E. Reroute signal wires, lighting, and power wiring as required to maintain services that are to remain and/or unaffected by the renovations. Where walls and ceilings are to be removed as shown on the Drawings, the conduit is to be cut off by the Electrical Trades so that the abandoned conduit in these walls and ceilings may be removed with the walls and ceilings by the Architectural Trades. All dead-end conduit runs shall be plugged at the remaining line outlet boxes or the panels.
- F. Where new walls and/or floors are installed which interfere with existing outlets, devices, etc., the Electrical Trades shall adjust, extend and reconnect such items as required to maintain continuity of same.
- G. All electrical work in altered and unaltered areas shall be run concealed wherever possible. Use of surface raceway or exposed conduits will be permitted only where specifically indicated on the drawings or approved by the Architect/Engineer.

- H. Existing lighting shall be reused where indicated on plans. Reused fixtures shall be detergent cleaned, re-lamped, and reconditioned suitable for satisfactory operation and appearance.

### **3.03 INSTALLATION OF EQUIPMENT**

- A. Install all equipment in strict accordance with all directions and recommendations furnished by the manufacturer. Where such directions conflict with the Drawings and Specifications, report such conflicts to the Architect/Engineer for resolution.
- B. Device Location:
  - 1. Allow for wiring devices, control devices, and fire alarm devices to be relocated within a 10' radius to accommodate final coordination with furnishings and other finish elements. Devices relocated prior to installation shall be done without additional cost to the project.

### **3.04 WORK IN EXISTING BUILDINGS**

- A. The Owner will provide access to existing buildings as required. Access requirements to occupied buildings shall be identified on the project schedule. The Contractor, once Work is started in the existing building, shall complete same without interruption to return work areas as soon as possible to Owner.
- B. Adequately protect and preserve all existing and newly installed Work. Promptly repair any damage to same at Contractor's expense.
- C. Consult with the Owner's Representative as to the methods of carrying on the Work so as not to interfere with the Owner's operation any more than necessary. Accordingly, all service lines shall be kept in operation as long as possible and the services shall only be interrupted at such time as will be designated by the Owner's Representative.

### **3.05 TEMPORARY SERVICES**

- A. Provide and remove upon completion of the project, following the general conditions and as described in Division 01, a complete temporary electrical and telephone service during construction.

### **3.06 DISPOSAL**

- A. Fluorescent Lamps
  - 1. Fluorescent lamps are known to contain mercury and are classified as hazardous material. All fluorescent lamps shall be assumed to contain mercury unless tested and confirmed otherwise with a toxicity characteristic leaching procedure (TCLP).
  - 2. Hazardous materials (fluorescent lamps), shall be sent to a lamp recycling facility. The materials shall be properly packaged with labels that meet the Department of Transportation Regulations and stored in a secure location before transportation.
  - 3. The Contractor shall identify the costs of the lamp disposal process including, but not limited to, the lamp packaging, storage, transportation, disposal, and any profile fees.
  - 4. Upon completion of the project, provide documentation to verify that the lamps have been properly disposed of in accordance with all local, state, and federal guidelines.
- B. Ballasts
  - 1. Lighting ballasts manufactured prior to 1979 have been known to contain polychlorinated biphenyls (PCBs). Unless specifically noted on the ballast as containing "No PCBs," the ballast shall be assumed to contain components with PCB materials.
  - 2. Hazardous materials (ballasts with PCBs), shall be disposed of at a hazardous waste incineration facility, or at a recycling facility in accordance with the Code of Federal Regulations as administered by the EPA in regards to this issue. The ballasts shall be packaged/stored in fifty-five gallon steel drums with labels that meet the Department of Transportation Regulations.
  - 3. The Contractor shall identify the costs of the ballast disposal process including, but not limited to, the packaging, storage, transportation, disposal, and any profile fees.
  - 4. Provide at completion of the project documentation (manifests) to verify that the ballasts have properly been disposed of in accordance with all local, state, and federal guidelines.

### **3.07 CHASES AND RECESSES**

- A. Provided by the architectural trades, but the Contractor shall be responsible for their accurate location and size.

### **3.08 CUTTING, PATCHING AND DAMAGE TO OTHER WORK**

- A. Refer to General Conditions for requirements.
- B. All cutting, patching, and repair work shall be performed by the Contractor through approved, qualified subcontractors. Contractor shall include full cost of same in bid.

### **3.09 EXCAVATION AND BACKFILLING**

- A. Provide all excavation, trenching, tunneling, dewatering, and backfilling required for the electrical work. Coordinate the work with other excavating and backfilling in the same area.
- B. Where conduit is installed less than 2'6" below the surface of pavement, provide concrete encasement, 4" minimum coverage, all around or as shown on the electrical Drawings.
- C. Backfill all excavations with well-tamped granular material. Backfill all excavations under wall footings with lean mix concrete up to underside of footings and extend concrete within excavation a minimum of four (4) feet each side of footing. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- D. Backfill all excavations inside building, under drives, and parking areas with well-tamped granular material. Granular backfill shall be placed in layers not more than 8 inches in thickness, 95 percent compaction throughout with approved compaction equipment. Tamp, roll as required. Excavated material shall not be used.
- E. Backfill outside building with granular material to a height 12 inches over top of pipe compacted to 95 percent compaction as specified above. Backfill remainder of excavation with unfrozen excavated material in such a way as to prevent settling.

### **3.10 EQUIPMENT CONNECTIONS**

- A. Make connections to equipment and other items included in the work in accordance with the approved shop Drawings and rough-in measurements furnished by the manufacturers of the particular equipment furnished. All additional connections not shown on the Drawings, but called out by the equipment manufacturer's shop Drawings shall be provided.

### **3.11 CLEANING**

- A. All debris shall be removed daily as required to maintain the work area in a neat, orderly condition.
- B. Final cleanup shall include, but not be limited to, washing of fixture lenses or louvers, switchboards, substations, motor control centers, panels, etc. Fixture reflectors and lenses or louvers shall be left with no water marks or cleaning streaks.

### **3.12 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS**

- A. Equipment and materials shall be protected from theft, injury, or damage.
- B. Protect conduit openings with temporary plugs or caps.
- C. Provide adequate storage for all equipment and materials delivered to the job site. Location of the space will be designated by the Owner's representative or Architect/Engineer. Equipment set in place in unprotected areas must be provided with temporary protection.

### **3.13 EXTRA WORK**

- A. For additional electrical work which may be proposed or requested, furnish an itemized cost breakdown of material and labor required to complete the work. Proceed only after receiving a written authorization.
- B. Before providing an itemized break-down for additional electrical work, submit unit prices for the following items: 1/2", 3/4", 1", 1-1/2" EMT conduit; #12, #10, #8, #6, #2 building wire; duplex receptacles, GFCI receptacles, data box and raceway, V4000 wiremold, and fittings, and other common electrical work which may be anticipated for any future revisions. These unit costs, once agreed to, shall be applied to additions and deducts for all project change orders.

### **3.14 DRAWINGS AND MEASUREMENTS**

- A. The Drawings are not intended to be scaled for rough-in measurements nor to serve as Shop Drawings. Field measurements necessary for ordering materials and fitting the installation to the building construction and arrangement are the Contractor's responsibility. The Contractor shall check latest Architectural Drawings and locate light switches from same where door swings are different from Electrical Drawings.

**END OF SECTION**

This page intentionally left blank



**SECTION 26 05 19 - CONDUCTORS AND CABLES**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 SUBMITTALS ..... 1  
1.04 QUALITY ASSURANCE ..... 1  
PART 2 PRODUCTS ..... 1  
2.01 COPPER BUILDING WIRE ..... 1  
2.02 ALUMINUM BUILDING WIRE ..... 2  
2.03 METAL-CLAD CABLE, TYPE MC ..... 2  
2.04 CONNECTORS AND SPLICES ..... 2  
PART 3 EXECUTION ..... 3  
3.01 CONDUCTOR MATERIAL APPLICATIONS ..... 3  
3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING  
METHODS ..... 3  
3.03 INSTALLATION OF CONDUCTORS AND CABLES ..... 3  
3.04 CONNECTIONS ..... 3  
3.05 IDENTIFICATION ..... 4  
3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS ..... 4  
3.07 FIRESTOPPING ..... 4  
3.08 FIELD QUALITY CONTROL ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section includes:
  - 1. Building wires and cables rated 600V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

**1.03 SUBMITTALS**

- A. Field Quality-Control Test Reports
- B. Submit letter of compliance (intent) for general building wire and cable. Provide product data for the following:
  - 1. Metal-Clad Cable, Type MC

**1.04 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**

**2.01 COPPER BUILDING WIRE**

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
- D. Conductor Insulation:
  - 1. Type THHN/THWN-2: Comply with UL 83.
  - 2. Type THW/THW-2: Comply with NEMA WC-70/ICEA S-95-658 and UL 83.
  - 3. Type XHHW-2: Comply with UL 44.

## 2.02 ALUMINUM BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
  - 1. Allowed only for conductors used in feeders 100A and larger.
- B. Manufacturers:
  - 1. General Cable.
  - 2. Southwire.
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Aluminum, complying with ASTM B 800 and ASTM B 801.
- E. Conductor Insulation:
  - 1. Type XHHW-2: Comply with UL 44.

## 2.03 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers:
  - 1. AFC Cable Systems.
  - 2. Alpha Wire Company.
  - 3. American Bare Conductor.
  - 4. Belden.
  - 5. Encore.
  - 6. General Cable.
  - 7. Okonite.
  - 8. Service Wire Co.
  - 9. Southwire Company.
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. Comply with UL 1569.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
  - 1. Single circuit and multi-circuit with color-coded conductors for branch circuit distribution.
  - 2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors:
  - 1. Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.
  - 2. Aluminum, complying with ASTM B 800 and ASTM B 801 for conductors #1 AWG and larger.
- F. Ground Conductor: Insulated. Ground conductor sized as indicated on drawings (reduced ground conductor is not acceptable).
- G. Conductor Insulation:
  - 1. Type TFN/THHN/THWN-2: Comply with UL 83.
  - 2. Type XHHW-2: Comply with UL 44.
- H. Armor: Aluminum, interlocked.

## 2.04 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## **PART 3 EXECUTION**

### **3.01 CONDUCTOR MATERIAL APPLICATIONS**

- A. Refer to application schedule on the drawings
- B. If providing aluminum feeders, contractor is responsible for providing correct feeder, equipment ground and conduit size based on voltage drop and any de-rating required.
- C. Feeders and Branch Circuits: Solid or stranded for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- D. Each feeder shall be of the same conductor and insulation material (phase, neutral, and parallel).
- E. Use conductor not smaller than 14 AWG for control circuits,
- F. Where equipment is listed for use with copper conductors only, use copper conductors for the entire length of feeder.

### **3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Refer to application schedule on the drawings
- B. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel wire-mesh strain relief device at terminations to suit application.
- C. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
- D. Class 2 Control Circuits: Type THHN/THWN-2, in raceway.

### **3.03 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- G. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- H. Provide a separate neutral conductor for each circuit unless multi-wire branch circuits are specifically indicated on the drawings.
- I. Electrical Contractor shall be responsible for de-rating of conductors as required by N.E.C. when more than three current carrying conductors are installed in a single raceway or cable. Neutral conductors shall be considered current carrying conductors.
- J. Type MC cable shall be supported and secured at intervals not exceeding 4'-0" in new construction
- K. Where MC cable is permitted by the specifications, MC cable shall not be bundled.
- L. Between support, hangers and termination no more than 3" deflection from the bottom of the cable to a horizontal line between the support/hanger or termination.
- M. Do not route conductors across roof without prior approval from engineer.

### **3.04 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 un-spliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
  - 2. Use compression type terminations for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.
- D. Clean conductor surfaces before installing lugs and connectors.

- E. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- F. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
- G. Use piercing connector with insulating covers for conductor splices and taps, 8 AWG and larger only for taps to existing feeders. Do not use piercing connectors in new construction.
- H. Use Sta-Kon connectors to terminate stranded conductors #10 AWG and smaller to screw terminals.
- I. Use insulated spring wire connectors with plastic caps (wire nuts) for copper conductor splices and taps, 10 AWG and smaller. Push-in style connectors are not permitted.
- J. Provide lugs suitable for bussing and conductor material used.

### **3.05 IDENTIFICATION**

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### **3.06 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 33 "Raceways and Boxes."

### **3.07 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping".

### **3.08 FIELD QUALITY CONTROL**

- A. Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Description: Test all feeders rated 100 A and above.
  - 2. Visual and Mechanical Inspection
    - a. Inspect cables for physical damage and proper connection in accordance with the one line diagram.
    - b. Test cable mechanical connections with an infrared survey.
    - c. Check cable color-coding against project Specifications and N.E.C. requirements.
  - 3. Electrical Tests
    - a. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors. Applied potential to be 1000 volts dc for 1 minute.
    - b. Perform continuity test to insure proper cable connection.
  - 4. Test Values
    - a. Minimum insulation resistance values shall be not less than fifty mega-ohms.
- B. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

**END OF SECTION**

**SECTION 26 0526 - GROUNDING AND BONDING**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 REFERENCES ..... 1  
1.04 SUBMITTALS ..... 1  
1.05 PROJECT RECORD DOCUMENTS ..... 2  
1.06 QUALITY ASSURANCE ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 MANUFACTURERS ..... 2  
2.02 GROUNDING CONDUCTORS ..... 2  
2.03 CONNECTOR PRODUCTS ..... 3  
2.04 GROUNDING ELECTRODES ..... 3  
PART 3 EXECUTION ..... 3  
3.01 EQUIPMENT GROUNDING ..... 3  
3.02 CONNECTIONS ..... 4  
3.03 INSTALLATION ..... 4  
3.04 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING ..... 5  
3.05 TELECOMMUNICATIONS GROUNDING ..... 6  
3.06 FIELD QUALITY CONTROL ..... 6

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.
- B. Related Sections include the following:
  - 1. Division 26 Section "Underground Ducts and Utility Structures" for ground test wells.
  - 2. Division 26 Section "Electrical General Requirements".
  - 3. Division 26 Section "Conductors and Cables".

**1.03 REFERENCES**

- A. ASTM B 3: Specification for Soft or Annealed Copper Wire.
- B. ASTM B 8: Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard or Soft.
- C. ASTM B 33: Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes.
- D. ASTM B 187: Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes.
- E. IEEE 81: Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
- F. IEEE 142: Grounding of Industrial and Commercial Power Systems.
- G. IEEE C2: National Electrical Safety Code.
- H. NETA MTS – 2001: Maintenance Testing Specifications.
- I. NFPA 70: National Electrical Code.
- J. NFPA 70B: Recommended Practice for Electrical Equipment Maintenance.
- K. TIA/EIA 607: Commercial Building Grounding and Bonding Requirements Standard.
- L. UL 467: Grounding and Bonding Equipment.
- M. UL 486 A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- N. UL 486B: Wire Connectors for Use with Aluminum Conductors.

**1.04 SUBMITTALS**

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article.
- B. Field Test Reports: Submit written test reports to include 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.
4. Indicate overall system resistance to ground.
5. Indicate overall Telecommunications system resistance to ground.

#### **1.05 PROJECT RECORD DOCUMENTS**

- A. Submit under provisions of Division 26 "Electrical General Requirements".
- B. Accurately record actual locations of grounding electrodes and connections to building steel.

#### **1.06 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Refer to specification section "Electrical Testing."
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  1. Comply with UL 467.
- C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.
- D. Comply with ANSI/TIA/EIA-607 "Standard for Commercial Building Grounding and Bonding Requirements for Telecommunications".

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Grounding Conductors and Cables:
    - a. Refer to Division 26 Section "Conductors and Cables".
  2. Grounding Rods:
    - a. American Electric-Blackburn.
    - b. Apache Grounding/Erico Inc.
    - c. Chance/Hubbell.
  3. Mechanical Connectors:
    - a. American Electric-Blackburn.
    - b. Burndy.
    - c. Chance/Hubbell.
  4. Exothermic Connections:
    - a. Cadweld.
  5. Compression-type Connectors:
    - a. Burndy HyGround
    - b. Blackburn EZ Ground.
    - c. Panduit.

#### **2.02 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Material: Aluminum, copper-clad aluminum, and copper.
- C. Equipment Grounding Conductors: Insulated with green-colored insulation.
- D. Grounding Electrode Conductors: Stranded cable.
- E. Underground Conductors: Bare, stranded, copper unless otherwise indicated.
- F. Bare Copper Conductors: Comply with the following:
  1. Solid Conductors: ASTM B 3.
  2. Assembly of Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
- G. Copper Bonding Conductors: As follows:
  1. Bonding Conductor: Stranded copper conductor; size per the NEC.
  2. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; size per the NEC.
  3. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; size per the NEC.

- H. Aluminum Bonding Conductors: As follows:
  - 1. Bonding Conductor: Stranded aluminum conductor; size per the NEC.
  - 2. Bonding Jumper: Aluminum tape, braided bare aluminum conductors, terminated with aluminum ferrules; size per the NEC.
- I. Ground Conductor and Conductor Protector for Wood Poles: As follows:
  - 1. No. 4 AWG minimum, soft-drawn copper conductor.
  - 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.
- J. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.
- K. Telecommunications Grounding Busbar (TGB)
  - 1. 12" (min) x 2" x 1/4" tin plated, copper busbar with two rows of 1/4 x 20 tapped holes 3" on center.
- L. Telecommunications Bonding Backbone (TBB)
  - 1. Minimum No. 2 AWG insulated stranded copper.
- M. Telecommunications Bonding Conductors
  - 1. Minimum No. 6 AWG insulated stranded copper.

### **2.03 CONNECTOR PRODUCTS**

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected for the specific application per manufacturer's written instructions.
- D. Compression-Type Connectors: Pure, wrought copper, per ASTM B187.

### **2.04 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel.
  - 1. Size: 5/8 in diameter.
  - 2. Length: 120 inches.
- B. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Provide handholes as specified in Division 2 Section "Underground Ducts and Utility Structures."

## **PART 3 EXECUTION**

### **3.01 EQUIPMENT GROUNDING**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- C. Underground Grounding Conductors: No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.
- D. In raceways, use insulated equipment grounding conductors.
- E. Install equipment grounding conductors in all feeders and circuits. Terminate each end on suitable lugs, bus or bushing.
- F. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- G. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.
- H. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- I. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a separate equipment grounding conductor with supply branch-circuit conductors. Bond pole and foundation reinforcing steel to equipment ground conductor.
- J. Verify specific equipment grounding requirements with the manufacturer's recommendations.

### 3.02 CONNECTIONS

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.
  - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding Conductor Terminations
  - 1. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and larger.
  - 2. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.
- F. Tighten screws and bolts for grounding and bonding 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 or UL 486B as applicable.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Connections shall be non-reversible. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

### 3.03 INSTALLATION

- A. Equipotential Ground: Interconnect grounding electrodes to form one, electrically continuous, equipotential grounding electrode system. Grounding electrodes to be interconnected include:
  - 1. Ground rods.
  - 2. Counterpoise ground.
  - 3. Ufer ground.
  - 4. Metal water service pipe.
- B. Ground Rods: 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.
  - 1. Verify that final backfill and compaction has been complete before driving ground rods.
  - 2. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 3. Interconnect ground rods with grounding electrode conductors. Use exothermic welds or non-reversing compression-type connectors, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- C. Counterpoise Ground:
  - 1. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet apart.
  - 2. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use conductors not less than



No. 2/0 AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 18 inches below grade and 24 inches from building foundation.

- D. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250-81(c):
  - 1. Provide a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet long, coil excess conductor within the base of the foundation.
  - 2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts.
  - 3. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.
- E. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Install in conduit where routed above grade.
  - 1. Aluminum and copper-clad aluminum conductors shall not be used in direct contact with masonry, within 18 inches of the earth, or where subject to corrosive conditions.
- F. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors or non-reversing compression-type connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.
- G. Metal Water Service Pipes in direct contact with the earth for 10 feet: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to all metal water service entrances to building including fire protection water service entrance. Connect grounding conductors to metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- H. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.
- I. Bond interior metal piping systems, including any portions of metal piping systems separated by non-metal piping, and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- J. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.
- K. Grounding Bus:
  - 1. Install grounding bus in the locations listed below and elsewhere as indicated:
    - a. Electrical equipment rooms.
    - b. Telephone equipment rooms.
  - 2. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
- L. Equipment Grounding: Provide a permanent and continuous bonding of conductor enclosures, equipment frames, power distribution equipment ground busses, cable trays, metallic raceways, and other non-current carrying metallic parts of the electrical system.
- M. Bond together metal building elements not attached to grounded structure; bond to ground.
- N. Provide a flexible braid bonding jumper at each set of columns at expansion joints.

### 3.04 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

- A. Manholes and Handholes: Install a driven ground rod close to wall, inside manhole, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- B. Connections to Manhole Components: Connect all exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

### 3.05 TELECOMMUNICATIONS GROUNDING

- A. Telecommunications Grounding System: The telecommunications grounding system shall consist of:
  - 1. A Telecommunications Grounding Busbar (TGB) in each telecommunications room, cabinets, etc.
  - 2. A Telecommunications Bonding Backbone (TBB) tying together the TMGB and each TGB.
  - 3. Bonding of all equipment racks, raceways, non-current carrying metallic equipment and surge protection devices within the telecommunications room to the TGB's or TMGB using approved bonding conductors. Each piece of equipment shall be bonded individually directly to the ground bus.
- B. All bonding connections shall be installed at an accessible location for inspection and maintenance.
- C. All telecommunications bonding connections shall be of an approved mechanical type connection. Do not use exothermic welds unless specifically indicated on the Drawings.
- D. The physical routing shall, in general, follow the same path as the backbone cable system.
- E. Bond each TGB directly to the building steel with a No. 6 AWG conductor.
- F. Do not use TGB's as a power system ground connection unless specifically noted on the Drawings.
- G. All bonding connectors and conductors shall be UL listed for the purpose intended.
- H. Mount TGB bus to backboard or wall using 2" standoff insulators.
- I. Individually bond each piece of non-current carrying metallic equipment in the Telecommunications Room to the TGB.
- J. Install continuous cable from the TMGB to the furthest TGB. Bond all TGB's to TBB with bare No. 3/0 AWG copper ground conductor and T-tap grounding hardware.

### 3.06 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 1. Inspect grounding and bonding system conductors and connections for tightness and proper installation and for compliance with the Drawings and Specifications.
  - 2. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
    - a. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal.
    - b. Measure ground resistance not less than two full days after the last trace of precipitation, and without the 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.
    - c. Perform tests, by the fall-of-potential method according to IEEE 81. Instrumentation utilized shall be as defined in Section 12 of IEEE 81 and shall be specifically designed for ground impedance testing. Provide sufficient spacing so that curves flatten in the 62% area of the distance between the item under test and the current electrode.
  - 3. Provide 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.
    - a. Equipment Rated 500 kVA and Less: 10 ohms.
    - b. Manhole Grounds: 10 ohms.
    - c. The telecommunications grounding system shall have a maximum resistance of 1 ohm as measured from the TMGB ground to earth ground.
  - 4. 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  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 PERFORMANCE REQUIREMENTS ..... 1  
1.05 QUALITY ASSURANCE ..... 1  
1.06 COORDINATION ..... 1  
PART 2 PRODUCTS ..... 1  
2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS ..... 1  
2.02 BACKBOARDS ..... 2  
PART 3 EXECUTION ..... 2  
3.01 APPLICATION ..... 2  
3.02 SUPPORT INSTALLATION ..... 3  
3.03 BACKBOARDS ..... 4  
3.04 PAINTING ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

**1.04 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

**1.05 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

**1.06 COORDINATION**

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

**PART 2 PRODUCTS**

**2.01 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; a part of Atkore International.
    - b. B-Line, by Eaton.
    - c. GS Metals Corp.
    - d. Pentair Electrical & Fastening Solutions.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; a part of Atkore International.

- g. Wesanco, Inc.
  2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  4. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: 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 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) B-Line by Eaton.
      - 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.

## 2.02 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 6 Section "Rough Carpentry." Plywood sheets shall be free of all voids. Plywood shall have a minimum of two coats of fire-resistant, non-conducting paint applied to all sides of all sheets. Provide flush hardware and supports to mount plywood to wall. The provided hardware shall have sufficient strength to carry all anticipated loads including, but not limited to cabling, cable management and equipment racks.

## PART 3 EXECUTION

### 3.01 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 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:
    - a. Two-bolt conduit clamps
    - b. Single-bolt conduit clamps
    - c. Single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Support single runs of MC cable using spring-steel clamps from suspended ceiling hangers, hanger wire or building structure at intervals not to exceed three feet. Do not support MC cable from ceiling grid.

### 3.02 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 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:
    - a. Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
    - b. Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69
    - c. 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 support systems attached to substrate.
- E. Slotted support systems applications:
  - 1. Indoor dry and damp Locations: Painted Steel
  - 2. Outdoors and interior wet locations: Galvanized Steel
  - 3. Corrosive Environments, including pool equipment rooms: Nonmetallic
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- G. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.
- H. Obtain permission from Architect/Engineer before using powder-actuated anchors.
- I. Obtain permission from Architect/Engineer before drilling or cutting structural members.
- J. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.
- K. Install surface-mounted cabinets and panelboards with minimum of four anchors.
- L. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch off wall.
- M. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- N. The Contractor shall replace all supports and channels that sag, twist, and/or show signs of not providing proper structural support, to the equipment, it is intended for, as determined by the Owner and Architect/Engineer. All costs associated with replacing supports and steel channels shall be incurred by the Contractor.

### **3.03 BACKBOARDS**

- A. A minimum of two walls (or as indicated on drawings) shall be covered with plywood backboards to a minimum 8'-6" above finished floor in all Telecommunication Rooms and similar spaces and as indicated on Drawings.
- B. Securely fasten backboard to wall using appropriate hardware and mount at all four corners, minimum. Securely fasten backboard to wall-framing members (studs).
- C. Provide adequate backboard space to allow a clean and workable arrangement for telephone and data connections.

### **3.04 PAINTING**

- A. 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.
- 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 26 05 33 - RACEWAYS AND BOXES**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 SUBMITTALS ..... 1  
1.05 QUALITY ASSURANCE ..... 2  
1.06 COORDINATION ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 METAL CONDUIT AND TUBING ..... 2  
2.02 NONMETALLIC CONDUIT AND TUBING ..... 2  
2.03 METAL WIREWAYS ..... 3  
2.04 SURFACE RACEWAYS ..... 3  
2.05 BOXES, ENCLOSURES, AND CABINETS ..... 3  
2.06 SLEEVES FOR RACEWAYS ..... 3  
2.07 SLEEVE SEALS ..... 4  
2.08 GROUT ..... 4  
PART 3 EXECUTION ..... 4  
3.01 RACEWAY APPLICATION ..... 4  
3.02 INSTALLATION ..... 4  
3.03 SLEEVE INSTALLATION FOR ELECTRICAL AND COMMUNICATIONS PENETRATIONS ..... 6  
3.04 SLEEVE-SEAL INSTALLATION ..... 7  
3.05 FIRESTOPPING ..... 7  
3.06 PROTECTION ..... 7  
3.07 CLEANING ..... 7

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Division 26 Section, "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes and underground utility construction.
  - 2. Division 07 Section, "Penetration Firestopping" for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
  - 3. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings, and for access floor boxes and service poles.
  - 4. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

**1.03 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.
- H. PVC: Polyvinyl Chloride.
- I. HDPE: High Density Polyethylene.
- J. RTRC: Reinforced Thermosetting Resin Conduit

**1.04 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

## 1.05 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.

## 1.06 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 PRODUCTS

### 2.01 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Allied Tube Triangle Century.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. International Metal Hose.
  - 6. Electri-Flex Co
  - 7. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  - 8. LTV Steel Tubular Products Company – Manhattan/CDT/Cole-Flex.
  - 9. Maverick.
  - 10. O-Z Gedney; unit of General Signal.
  - 11. Wheatland.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- E. EMT: ANSI C80.3.
- F. FMC: Zinc-coated steel or Aluminum.
- 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: Steel, set-screw type.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

### 2.02 NONMETALLIC CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American International.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arncorp Corp.
  - 4. Cantex Inc.
  - 5. Certainteed Corp.; Pipe and Plastics Group.
  - 6. Condux International.
  - 7. ElecSys, Inc.
  - 8. Electri-Flex Co.
  - 9. Integral.
  - 10. Kor-Kap.
  - 11. Lamson and Sessions: Carlon Electrical Products.
  - 12. Manhattan/CDT/Cole-Flex.
  - 13. RACO; Division of Hubbell, Inc.
  - 14. Scepter.
  - 15. Spiralduct, Inc./AFC Cable Systems, Inc.



- 16. Thomas & Betts Corporation.
- B. ENT: NEMA TC 13.
- C. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.
- D. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.
- E. LFNC: UL 1660.
- F. HDPE: UL 651, ASTM D 3350, ASTM D 1248 Schedule 40.
- G. RTRC: Comply with UL 2515A and NEMA TC 14.

### 2.03 METAL WIREWAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hoffman.
  - 2. Square D.
- B. Material and Construction: Sheet metal, NEMA 1.
- 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. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers: Screw-cover type.
- F. Finish: Manufacturer's standard enamel finish.

### 2.04 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Airey-Thompson Sentinel Lighting: Wiremold Company (The).
    - b. Thomas & Betts Corporation.
    - c. Walker Systems, Inc.; Wiremold Company (The).
    - d. Wiremold Company (The); Electrical Sales Division.
    - e. Mono-Systems, Inc.
- B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

### 2.05 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1. Shall be used within walls or ceiling.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Shall be used in all exposed, non-recessed, locations.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Shall be used in areas exposed to water.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

### 2.06 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Through-Penetration Firestop Systems."

## 2.07 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Stainless steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.08 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

### 3.01 RACEWAY APPLICATION

- A. Provide raceways in interior and exterior locations in accordance with the "Raceway Application Matrix" included on the drawings.
- B. Boxes and Enclosures, Exterior Aboveground: NEMA 250, Type 3R.
- C. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- D. Minimum Raceway Size: 3/4-inch trade size.
- E. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
  - 3. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.02 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Install temporary closures to prevent foreign matter from entering raceways.
- F. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- J. Support conduit within 12 inches of enclosures to which attached.
- K. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  1. Run parallel or banked raceways together on common supports.
  2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- Q. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
- S. 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.
- T. Provide pull string and 25% spare capacity in every branch circuit conduit.
- U. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-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 otherwise required by NFPA 70.
- V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- W. Expansion-Joint Fittings:
  1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- X. Flexible Conduit Connections: Comply with NEMA RV3. Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- Y. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Provide cover clips to cover space between connecting pieces.
- Z. 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.
- AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- BB. Locate boxes so that cover or plate will not span different building finishes.
- CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- EE. Set floor boxes level and flush with finished floor surface. Trim non-metallic boxes after installation to fit flush with finished floor surface.
- FF. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- GG. Do not route feeders across roof.
- HH. Provide a pull box (a handhole for outdoor applications) for each conduit run that exceeds 250 feet. Provide two pull boxes (handholes for outdoor applications) for runs that exceed 500 feet.
- II. Route conduits in finished areas with exposed ceilings at underside of structural deck or as high as possible.

### **3.03 SLEEVE INSTALLATION FOR ELECTRICAL AND COMMUNICATIONS PENETRATIONS**

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  2. For sleeve cross-section 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 surfaces of walls.
- 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 raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 7 Section "Through-Penetration Firestop Systems."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch 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 raceway and sleeve for installing mechanical sleeve seals.

#### **3.04 SLEEVE-SEAL INSTALLATION**

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

#### **3.05 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Through-Penetration Firestop Systems."

#### **3.06 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

#### **3.07 CLEANING**

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

**END OF SECTION**

This page intentionally left blank

**SECTION 26 05 43 - UNDERGROUND DUCTS AND UTILITY STRUCTURES**

PART 1 GENERAL ..... 1  
1.01 SUMMARY ..... 1  
1.02 DEFINITION ..... 1  
1.03 SUBMITTALS ..... 1  
1.04 QUALITY ASSURANCE ..... 2  
1.05 DELIVERY, STORAGE, AND HANDLING ..... 2  
1.06 PROJECT CONDITIONS ..... 2  
1.07 COORDINATION ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 METAL CONDUIT AND FITTINGS ..... 2  
2.02 RIGID NONMETALLIC DUCT ..... 2  
2.03 FLEXIBLE NONMETALLIC DUCTS ..... 3  
2.04 DUCT ACCESSORIES ..... 3  
2.05 PRECAST CONCRETE HANDHOLES AND BOXES ..... 3  
2.06 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE ..... 4  
2.07 UTILITY STRUCTURE ACCESSORIES ..... 4  
2.08 SOURCE QUALITY CONTROL ..... 5  
PART 3 EXECUTION ..... 5  
3.01 PREPARATION ..... 5  
3.02 UNDERGROUND DUCT APPLICATION ..... 5  
3.03 UNDERGROUND ENCLOSURE APPLICATION ..... 6  
3.04 EARTHWORK ..... 6  
3.05 DUCT INSTALLATION ..... 6  
3.06 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES ..... 7  
3.07 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE ..... 7  
3.08 GROUNDING ..... 8  
3.09 FIELD QUALITY CONTROL ..... 8  
3.10 CLEANING ..... 8

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. This section includes underground ducts and structures for electrical feeders and branch circuits 600V and below, electrical feeders over 600V, fiber optic cable systems, telecommunications and other similar facilities; including:
  - 1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
  - 2. Rigid nonmetallic duct.
  - 3. Flexible nonmetallic duct.
  - 4. Reinforced Thermosetting Resin Conduit
  - 5. Duct accessories.
  - 6. Precast concrete handholes.
  - 7. Polymer concrete handholes and boxes with polymer concrete cover.
  - 8. Fiberglass handholes and boxes with polymer concrete cover.
  - 9. Utility structure accessories.

**1.02 DEFINITION**

- A. RNC: Rigid nonmetallic conduit.

**1.03 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 handholes, and 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. Grounding details.
  5. 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.
- D. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C 858.
- E. Qualification Data: For professional engineer and testing agency.
- F. Source quality-control test reports.
- G. Field quality-control test reports.

#### **1.04 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.

#### **1.05 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.

#### **1.06 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 no fewer than seven days in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

#### **1.07 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.

### **PART 2 PRODUCTS**

#### **2.01 METAL CONDUIT AND FITTINGS**

- A. GRC: Comply with ANSI C80.1 and UL 6.
- B. Coated Steel Conduit: PVC-coated GRC.
  1. Comply with NEMA RN 1.
  2. Coating Thickness: 0.040 inch, minimum.
- C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

#### **2.02 RIGID NONMETALLIC DUCT**

- A. Underground Plastic Utilities Duct: Type EPC-80-PVC and Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.



- B. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- C. Solvents and Adhesives: As recommended by conduit manufacturer.

### 2.03 FLEXIBLE NONMETALLIC DUCTS

- A. HDPE Duct: Type EPEC-80 HDPE, complying with NEMA TC 7 and UL 651A.
  - 1. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

### 2.04 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape:
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC"
    - c. Inscriptions for Orange-Colored Tapes: "COMMUNICATION"
  - 3. Description:
    - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
    - b. Width: 3 inches.
    - c. Overall Thickness: 5 mils.
    - d. Foil Core Thickness: 0.35 mil.
    - e. Weight: 28 lb/1000 sq. ft.
    - f. Tensile according to ASTM D 882: 70 lbf and 4600 psi.

### 2.05 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Concrete Products.
  - 2. Carder Concrete Products.
  - 3. Christy Concrete Products.
  - 4. Elmhurst-Chicago Stone Co.
  - 5. Oldcastle Precast Group.
  - 6. Riverton Concrete Products; a division of Cretex Companies, Inc.
  - 7. Utility Concrete Products, LLC.
  - 8. Utility Vault Co.
  - 9. Wausau Tile, Inc.
- B. Comply with ASTM C 858 for design and manufacturing processes.
- C. 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. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  - 3. Cover Legend: Molded lettering, "ELECTRIC."
  - 4. Configuration: Units shall be designed for flush burial and have closed bottom.
  - 5. 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.

6. 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.
7. 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.

## **2.06 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE**

- A. Description: Comply with SCTE 77.
  1. Color: Gray where installed in concrete, Green where installed in landscape and turf areas.
  2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
  5. Cover Legend: Molded lettering, "ELECTRIC."
  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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Quazite.
    - b. Armorcast Products Company.
    - c. Carson Industries LLC.
    - d. CDR Systems Corporation.
    - e. NewBasis.
    - f. Christy Concrete Products.

## **2.07 UTILITY STRUCTURE ACCESSORIES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Bilco Company (The).
  2. Campbell Foundry Company.
  3. Carder Concrete Products.
  4. Christy Concrete Products.
  5. East Jordan Iron Works, Inc.
  6. Elmhurst-Chicago Stone Co.
  7. McKinley Iron Works, Inc.
  8. Neenah Foundry Company.
  9. NewBasis.
  10. Oldcastle Precast Group.
  11. Osburn Associates, Inc.
  12. Pennsylvania Insert Corporation.
  13. Riverton Concrete Products; a division of Cretex Companies, Inc.
  14. Strongwell Corporation; Lenoir City Division.
  15. Underground Devices, Inc.
  16. Utility Concrete Products, LLC.
  17. Utility Vault Co.
  18. Wausau Tile, Inc.
- B. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- diameter eye, and 1-by-4-inch bolt.
  1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.
- C. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- diameter eye, rated 2500-lbf minimum tension.

- D. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
  - 1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.
- E. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.
  - 1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
- F. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
- G. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
  - 1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.
  - 2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.
- H. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.

## **2.08 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**

### **3.01 PREPARATION**

- A. Coordinate layout and installation of duct, duct bank, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 31 00 00 "Earthwork".
- D. Remove and stockpile topsoil for reapplication according to Section 31 00 00 "Earthwork".

### **3.02 UNDERGROUND DUCT APPLICATION**

- A. Duct for Electrical Feeders 600 V and Less: Type EPC-80-PVC RNC, direct-buried unless otherwise indicated
- B. All underground ducts crossing driveways with truck traffic, roadways and railroads shall be encased in concrete including 10' on each side of the roadway or railway.
- C. Direct buried ducts shall be 1" minimum.
- D. Bored Underground Duct: Type EPEC-80-HDPE unless otherwise indicated.
  - 1. Perform directional bore in accordance with section 33 05 23 "Utility Horizontal Directional Drilling"
- E. Duct and conduit within five feet of building foundation wall shall be GRC.
- F. Stub-ups: Concrete-encased PVC-coated GRC unless otherwise indicated.

### 3.03 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
  - 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: Precast concrete, AASHTO HB 17, H-20 structural load rating.
  - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 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 vertical loading.

### 3.04 EARTHWORK

- A. Excavation and Backfill: Comply with Division 2 Section "Earthwork," 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 Division 2 Sections "Lawns and Grasses" and "Exterior Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 1 Section "Cutting and Patching."

### 3.05 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward 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, 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 o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
  - 2. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet 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 Division 26 Section "Basic Electrical Materials and Methods."
- 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 hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.
- H. 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 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 between tiers.
  - 3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 2 Section "Earthwork" for pipes less than 6 inches in nominal diameter.
  - 4. Install backfill as specified in Division 2 Section "Earthwork."
  - 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 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 Division 2 Section "Earthwork."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
  7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
  8. Set elevation of bottom of duct bank below the frost line.
  9. 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 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.
  10. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

### **3.06 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES**

- A. Precast Concrete Handhole Installation:
  1. Comply with ASTM C 891, unless otherwise indicated.
  2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
  3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- B. Elevations:
  1. Install handholes with bottom below the frost line, 42" below grade.
  2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
  3. Where indicated, cast handhole cover frame integrally with handhole structure.
- C. Waterproofing: Apply waterproofing to exterior surfaces of handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 7 Section "Elastomeric Sheet Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
- D. Hardware: 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.
- E. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### **3.07 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 sieve to No. 4 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 above finished grade.
- D. Install handholes and boxes with bottom below the frost line, 42" 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.

### **3.08 GROUNDING**

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding."

### **3.09 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 Division 26 Section "Grounding and Bonding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

### **3.10 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**

**SECTION 26 05 53 - ELECTRICAL IDENTIFICATION**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 QUALITY ASSURANCE ..... 1  
1.04 COORDINATION ..... 1  
PART 2 PRODUCTS ..... 1  
2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS ..... 1  
2.02 CONDUCTOR, COMMUNICATION AND CONTROL CABLE IDENTIFICATION MATERIALS ..... 2  
2.03 UNDERGROUND-LINE WARNING TAPE ..... 2  
2.04 WARNING LABELS AND SIGNS ..... 2  
2.05 EQUIPMENT IDENTIFICATION LABELS ..... 2  
2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS ..... 2  
2.07 WIRING DEVICE IDENTIFICATION ..... 2  
PART 3 EXECUTION ..... 2  
3.01 APPLICATION ..... 2  
3.02 INSTALLATION ..... 3

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 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. Equipment identification labels.
  - 6. Miscellaneous identification products.

**1.03 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

**1.04 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**

**2.01 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.

## **2.02 CONDUCTOR, 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.

## **2.03 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.

## **2.04 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. 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."

## **2.05 EQUIPMENT IDENTIFICATION LABELS**

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background. Minimum letter height shall be 3/8 inch.
- B. Outdoor Equipment Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## **2.06 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 9 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **2.07 WIRING DEVICE IDENTIFICATION**

- A. Description: Self adhesive label with black upper case letters on clear polyester label, font size 7.

## **PART 3 EXECUTION**

### **3.01 APPLICATION**

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service and Feeders More Than 400 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and marker tape. 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 marker tape. Identify each ungrounded conductor according to source and circuit number as indicated on Drawings. Identify control circuits by control wire number as indicated on shop drawings.



- E. Branch-Circuit Conductor Identification: Mark junction box covers in indelible ink with the panel and breaker numbers of other circuits contained within.
- F. Conductor Identification: Locate at each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection or termination point.
- G. 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.
- H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. 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.
- J. 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: Engraved, laminated acrylic or melamine label mechanically secured.
    - b. Outdoor Equipment: Stenciled.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - 2. Equipment to Be Labeled: If included on project. All items may not be on project.
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Disconnect switches.
    - c. Motor starters.
    - d. Push-button stations.
    - e. Remote-controlled switches, dimmer modules, and control devices.
- K. Wiring Device Identification Labels: On each faceplate install circuit designation label that is consistent with panelboard directories, and as-built plan drawings. Apply labels to receptacle faceplates centered below bottom outlet. Apply labels to toggle switch faceplates on backside.

### 3.02 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location:
  - 1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
  - 2. Conduit Markers: Provide identification for each power conduit containing conductors rated 400A or greater.
- C. Apply identification devices to surfaces 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 and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Grounded Conductor (Neutral): White.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
    - d. Ground Conductor (Neutral): Grey.
  - 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. 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 or concrete envelope exceeds 16 inches overall.
- I. Label information arrangement for 3 lines of text.
  - 1. Line one shall describe the panel or equipment. Line one example: "DP-XX," RP-XX," "T-XX," "EF-XX," etc.
  - 2. Line two shall describe the first disconnecting means feeding this panel or equipment. Line two example: "Fed from DP-XX," "Fed from RP-XX," etc.
  - 3. Line three indicates that location of the disconnecting means as identified in line two. Line three example: "First Floor Elect. Rm #XXX."
  - 4. Line four shall include "Via T-XX" when panel or equipment is fed from a transformer.
- J. Examples:

RP-1A FED FROM DP-1A ELECTRICAL ROOM A100 VIA T-1A	EF-1 FED FROM MCC-1A MECHANICAL ROOM F101	LP-1A LOCATED IN ELECTRICAL ROOM A100
---	---	---

- K. Fusible Enclosed Switches and Distribution Equipment: Install self-adhesive vinyl label indicating fuse rating and type on the outside of door on each fused switch.
- L. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.
- M. Degrease and clean surface to receive nameplates.
- N. Install nameplate and labels parallel to equipment lines.
- O. Secure nameplate to equipment front using screws.
- P. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.
- Q. Identify conduit using field painting where required.
- R. Paint bands 10 feet on center, and 4 inches minimum in width.

**END OF SECTION**

**SECTION 26 05 73 - OVERCURRENT DEVICE COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS**

PART 1 - GENERAL ..... 1  
1.1 RELATED DOCUMENTS ..... 1  
1.2 SCOPE ..... 1  
1.3 REFERENCES ..... 1  
1.4 SUBMITTALS FOR REVIEW/APPROVAL ..... 2  
1.5 SUBMITTALS FOR CONSTRUCTION ..... 2  
1.6 QUALIFICATIONS ..... 2  
1.7 COMPUTER SOFTWARE PROGRAMS ..... 2  
PART 2 - PRODUCTS ..... 2  
2.1 STUDIES ..... 2  
2.2 DATA COLLECTION ..... 2  
2.3 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY ..... 3  
2.4 PROTECTIVE DEVICE COORDINATION STUDY ..... 3  
2.5 ARC FLASH HAZARD ANALYSIS ..... 4  
2.6 REPORT SECTIONS ..... 4  
PART 3 - EXECUTION ..... 6  
3.1 FIELD ADJUSTMENT ..... 6  
3.2 ARC FLASH WARNING LABELS ..... 6

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

**1.02 SCOPE**

- A. The contractor shall furnish short-circuit and protective device coordination studies as prepared by the electrical equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E -Standard for Electrical Safety in the Workplace. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D prepared by the electrical equipment manufacturer.
- C. The scope of the studies shall include all new distribution equipment supplied by the equipment manufacturer under this contract as well as all directly affected existing distribution equipment at the customer facility.

**1.03 REFERENCES**

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
  - 1. IEEE 141 – Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
  - 2. IEEE 242 – Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
  - 3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis
  - 4. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings
  - 5. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
  - 6. IEEE 1584 -Guide for Performing Arc-Flash Hazard Calculations
- B. American National Standards Institute (ANSI):
  - 1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
  - 2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
  - 3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
  - 4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- C. The National Fire Protection Association (NFPA)
  - 1. NFPA 70 -National Electrical Code, latest edition
  - 2. NFPA 70E – Standard for Electrical Safety in the Workplace, latest edition.

#### **1.04 SUBMITTALS FOR REVIEW/APPROVAL**

- A. The short-circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

#### **1.05 SUBMITTALS FOR CONSTRUCTION**

- A. The results of the short-circuit, protective device coordination, and arc flash hazard analysis studies shall be summarized in a final report. Report shall be provided on electronic media. All literature shall be combined in one document and shall be properly bookmarked with all applicable sections.
- B. The report shall include the following sections:
  - 1. Executive Summary.
  - 2. Descriptions, purpose, basis and scope of the study.
  - 3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.
  - 4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection.
  - 5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout.
  - 6. Details of the incident energy and flash protection boundary calculations.
  - 7. Recommendations for system improvements, where needed.
  - 8. One-line diagram.
- C. Arc flash labels shall be provided in full size representation in PDF format and submitted with the study.
- D. The report shall be signed and sealed by the Professional Engineer supervising the study.

#### **1.06 QUALIFICATIONS**

- A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies.
- B. The Registered Professional Electrical Engineer shall be a full-time employee of the equipment manufacturer.
- C. The Registered Professional Electrical Engineer shall have a minimum of five (5) years of experience in performing power system studies and registered in the state where the project is located.
- D. The equipment manufacturer shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual arc flash hazard analysis it has performed in the past year.

#### **1.07 COMPUTER SOFTWARE PROGRAMS**

- A. Computer Software Programs: Subject to compliance with requirements, provide products by one of the following:
  - 1. EDSA Micro Corporation.
  - 2. SKM Systems Analysis, Inc.
  - 3. ESA Inc.
  - 4. CGI CYME.
  - 5. Operation Technology, Inc.

### **PART 2 PRODUCTS**

#### **2.01 STUDIES**

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E -Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D prepared by the equipment manufacturer.

#### **2.02 DATA COLLECTION**

- A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of

the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

- B. Source combination may include present and future motors and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner.
- D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data to satisfy the study requirements.

### **2.03 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY**

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.
- B. Transformer design impedances shall be used when test impedances are not available.
- C. Provide the following:
  - 1. Calculation methods and assumptions
  - 2. Selected base per unit quantities
  - 3. One-line diagram of the system being evaluated
  - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
  - 5. Tabulations of calculated quantities
  - 6. Results, conclusions, and recommendations.
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
  - 1. Electric utility's supply termination point
  - 2. Incoming switchgear
  - 3. Unit substation primary and secondary terminals
  - 4. Low voltage switchgear
  - 5. Motor control centers
  - 6. Standby generators and automatic transfer switches
  - 7. Branch circuit panelboards
  - 8. Other significant locations throughout the system.
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
  - 1. Evaluate equipment and protective devices and compare to short circuit ratings
  - 2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
  - 3. Notify design engineer in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

### **2.04 PROTECTIVE DEVICE COORDINATION STUDY**

- A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
  - 1. Electric utility's overcurrent protective device
  - 2. Medium voltage equipment overcurrent relays
  - 3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
  - 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  - 5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
  - 6. Conductor damage curves
  - 7. Ground fault protective devices, as applicable
  - 8. Pertinent motor starting characteristics and motor damage points, where applicable

9. Pertinent generator short-circuit decrement curve and generator damage point
  10. The largest feeder circuit breaker in each motor control center and applicable panelboard.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.
- G. For emergency and standby distribution paths, provide selective coordination tables to demonstrate tested upstream/downstream breaker pairs selectively coordinate across the full range of over currents, from overload to the maximum available fault current, and for the full range of overcurrent protective device opening times associate with those fault currents.

## 2.05 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.
- D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.
- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
  2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## 2.06 REPORT SECTIONS

- A. Input data shall include, but not be limited to the following:
1. Feeder input data including feeder type (cable or bus), size, length, number per phase, conduit type (magnetic or non-magnetic) and conductor material (copper or aluminum).
  2. Transformer input data, including winding connections, secondary neutral-ground connection, primary and secondary voltage ratings, kVA rating, impedance, % taps and phase shift.

3. Generation contribution data, (synchronous generators and Utility), including short-circuit reactance ( $X''d$ ), rated MVA, rated voltage, three-phase and single line-ground contribution (for Utility sources) and X/R ratio.
  4. Motor contribution data (induction motors and synchronous motors), including short-circuit reactance, rated horsepower or kVA, rated voltage, and X/R ratio.
- B. Short-Circuit Output Data shall include, but not be limited to the following reports:
1. Low Voltage Fault Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Equivalent impedance
  2. Momentary Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. Calculated asymmetrical fault currents
      - 1) Based on fault point X/R ratio
      - 2) Based on calculated symmetrical value multiplied by 1.6
      - 3) Based on calculated symmetrical value multiplied by 2.7
    - e. Equivalent impedance
  3. Interrupting Duty Report shall include a section for three-phase and unbalanced fault calculations and shall show the following information for each applicable location:
    - a. Voltage
    - b. Calculated symmetrical fault current magnitude and angle
    - c. Fault point X/R ratio
    - d. No AC Decrement (NACD) Ratio
    - e. Equivalent impedance
    - f. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a symmetrical basis
    - g. Multiplying factors for 2, 3, 5 and 8 cycle circuit breakers rated on a total basis
- C. Recommended Protective Device Settings:
1. Phase and Ground Relays:
    - a. Current transformer ratio
    - b. Current setting
    - c. Time setting
    - d. Instantaneous setting
    - e. Recommendations on improved relaying systems, if applicable.
  2. Circuit Breakers:
    - a. Adjustable pickups and time delays (long time, short time, ground)
    - b. Adjustable time-current characteristic
    - c. Adjustable instantaneous pickup
    - d. Recommendations on improved trip systems, if applicable.
- D. Incident energy and flash protection boundary calculations
1. Arcing fault magnitude
  2. Protective device clearing time
  3. Duration of arc
  4. Arc flash boundary
  5. Working distance
  6. Incident energy
  7. Hazard Risk Category
  8. Recommendations for arc flash energy reduction

### **PART 3 EXECUTION**

#### **3.01 FIELD ADJUSTMENT**

- A. The contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study.
- B. Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify design engineer in writing of any required major equipment modifications.

#### **3.02 ARC FLASH WARNING LABELS**

- A. The contractor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- C. The label for equipment where arc incident energy is calculated shall include the following, at a minimum:
  - 1. Location designation
  - 2. Nominal system voltage
  - 3. Arc flash boundary
  - 4. Incident energy
  - 5. Working distance
  - 6. Engineering report number, revision number and issue date.
- D. The label for equipment where arc incident energy is not calculated shall include the following, at a minimum:
  - 1. Location designation
  - 2. Nominal system voltage
  - 3. Arc flash boundary from NFPA 70E 2018 Table 130.7(C) 15(a)
  - 4. Arc flash PPE category from NFPA 70E 2018 Table 130.7(C) 15(a)
  - 5. Engineering report number, revision number and issue date.
- E. Labels shall be machine printed, with no field markings.
- F. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - 1. For each 480 and 208 volt panelboard, one arc flash label shall be provided.
  - 2. For each motor control center, one arc flash label shall be provided.
  - 3. For each low voltage switchboard, one arc flash label shall be provided.
  - 4. For each switchgear, one flash label shall be provided.
  - 5. For medium voltage switches one arc flash label shall be provided
- G. Labels shall be field installed by the contractor.

**END OF SECTION**



**SECTION 26 09 23 - LIGHTING CONTROL DEVICES**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 REFERENCES ..... 1  
1.04 DEFINITIONS ..... 1  
1.05 SUBMITTALS ..... 2  
1.06 QUALITY ASSURANCE ..... 2  
1.07 COORDINATION ..... 2  
1.08 DELIVERY, STORAGE, AND HANDLING ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS ..... 2  
2.02 OCCUPANCY SENSORS ..... 2  
2.03 WALL DIGITAL TIME SWITCH ..... 3  
PART 3 EXECUTION ..... 4  
3.01 OCCUPANCY SENSOR INSTALLATION ..... 4  
3.02 WIRING INSTALLATION ..... 4  
3.03 IDENTIFICATION ..... 4  
3.04 FIELD QUALITY CONTROL ..... 4  
3.05 ADJUSTING ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following lighting control devices:
  - 1. Occupancy sensors.
- B. Related Sections include the following:
  - 1. Division 26 Section "Electrical General Requirements".
  - 2. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.
  - 3. Division 26 Section "Dimming Controls" for architectural dimming system equipment.

**1.03 REFERENCES**

- A. IEEE C62.41: Guide for Surge Voltages in Low-Voltage AC Power Circuits.
- B. IEEE C136.10: Standard for Roadway Lighting Equipment Locking-Type Photocontrol Devices and Mating Receptacle Physical and Electrical Interchangeability and Testing.
- C. NEMA ICS 2: Industrial Control and Systems Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC Part 8: Disconnect Devices for Use in Industrial Control Equipment.
- D. NFPA 70: National Electrical Code.
- E. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
- F. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- G. UL 773: Plug-in, Locking Photocontrols for Use with Area Lighting.
- H. UL 773A: Nonindustrial Photoelectric Switches for Lighting Control.
- I. UL 917: Clock Operated Switches.
- J. UL 1449: Surge Protective Devices.
- K. UL 1598: Luminaires.
- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

**1.04 DEFINITIONS**

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.
- C. ULTRASONIC: Active emission of at least 35 kHz sound waves, using Doppler reflectance to detect motion.

- D. MICROPHONIC: Passive reception to listen for continued occupancy, with circuitry to filter out white noise.
- E. MULTI-Tech: Using PIR and ultrasonic or microphonic technologies in one sensor.

#### **1.05 SUBMITTALS**

- A. Product Data: For each type of product indicated including physical data and electrical performance.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Lighting plan showing location, orientation, and coverage area of each sensor.
  - 2. 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. Include the following:
  - 1. Description of operation and servicing procedures.
  - 2. List of major components.
  - 3. Recommended spare parts.
  - 4. Programming instructions and system operation procedures.

#### **1.06 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.

#### **1.07 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, fire-suppression system, and partition assemblies.
- B. Coordinate interface of lighting control devices with temperature controls specified in Division 23.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to the site under provisions of Division 26 Section "Electrical General Requirements".
- B. Store and protect products under provisions of Division 26 Section "Electrical General Requirements".

### **PART 2 PRODUCTS**

#### **2.01 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS**

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

#### **2.02 OCCUPANCY SENSORS**

- A. General
  - 1. Coordinate occupancy sensor locations, coverages and required quantities with manufacturer's recommendations. Coverage areas indicated on the Drawings are for minor motion (6 to 8 inches of hand movement). Provide additional occupancy sensors and control units as required to achieve complete minor motion coverage of the space indicated.
  - 2. Adjust occupancy sensors and test that complete minor motion coverage is obtained in accordance with Part 3. Provide written confirmation of testing to owner, architect and engineer.
  - 3. Provide occupancy sensors with a bypass switch to override the "ON" function in the event of sensor failure.
  - 4. Provide occupancy sensors with an LED indicator indicating when motion is being detected during testing and normal operation of the sensor.
  - 5. Provide occupancy sensors and occupancy sensor control units from single manufacturer.
- B. 360° Ceiling Mounted Dual Technology Occupancy Sensor
  - 1. Manufacturers:
    - a. Perfect Sense CDS.
    - b. Wattstopper DT 300
    - c. Hubbell Building Automation "OMNI-DT" Series.
    - d. Greengate OMC-DT-2000-R.
    - e. Sensorswitch CM-PDT-R.

- f. Philips LRM2255.
- g. Leviton OSC10-M0W.
- 2. Description: Ceiling mounted, 360° coverage, multi-tech sensing occupancy sensor.
  - a. Housing: White, thermoplastic, tamper resistant ceiling mount.
  - b. Functions: Automatic ON must sense motion from both ultrasonic and infrared sensing elements. Either technology shall maintain ON, with adjustable time delays.
  - c. Adjustments: User adjustable sensitivity adjustment shall be provided for each sensing technology. Time delay shall be adjustable from 30 seconds to 30 minutes.
  - d. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
  - e. Manual override function.
- C. 360° Ceiling Mounted Ultrasonic Occupancy Sensors
  - 1. Manufacturers:
    - a. Perfect Sense WDS.
    - b. Wattstopper "WT" Series.
    - c. Hubbell Building Automation "OMNI-US" Series.
    - d. Greengate OPC-U-2000.
    - e. Sensorswitch CM MPT-10.
    - f. Philips LRM2255.
    - g. Leviton OSC20-U0W.
  - 2. Description: Ceiling mounted, 360° coverage, ultrasonic or microphonics sensing occupancy sensor.
    - a. Housing: White, thermoplastic, tamper resistant.
    - b. Adjustments: Adjustments: User adjustable sensitivity and time delay. Time delay shall be adjustable from 30 seconds to 15 minutes.
    - c. Sensor shall operate on 24V DC power through control unit which supplies DC power to the sensor and provides relay contacts to control the lighting load and auxiliary contacts.
    - d. Manual override function.
- D. Occupancy Sensor Control Units:
  - 1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.
    - a. Control units shall be provided as required to power ceiling mounted occupancy sensors, control lighting loads and provide a minimum of one auxiliary contact.
    - b. Occupancy sensor control units shall mount external to 4" sq junction box in the ceiling space. Wiring between control unit and occupancy sensor shall be plenum rated.
    - c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
    - d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
    - e. It is acceptable to provide controls and auxiliary contacts as required integral to the ceiling sensor, provided all required contacts are provided.
    - f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

## 2.03 WALL DIGITAL TIME SWITCH

- A. Manufacturers:
  - 1. Greengate
  - 2. WattStopper
- B. Description: Self contained time control switch programmed to turn lights off after a preset time and designed to fit a standard single gang switch box in a Decora style switch plate with the following features:
  - 1. Ground wire and ground strap.
  - 2. Latching air gap relay switching mechanism.
  - 3. Zero Crossing Circuitry.
  - 4. Backlit Liquid Crystal Display that shows the timer's countdown.
  - 5. 100% OFF override switch with no leakage current to the load.
  - 6. Compatible with all electronic ballasts, motor loads, compact fluorescent and inductive loads.
  - 7. Concealed calibration switches of for programmable features.

8. Capable of operating as an ON/OFF switch.
- C. Operating parameters:
  1. 100-300 VAC; 50/60 Hz.
  2. 0 to 800 watt incandescent, fluorescent @ 100/120 VAC, 50/60 Hz
  3. 0 to 1200 watts fluorescent @ 230/277 VAC, 50/60 Hz
  4. 1/6 hp @ 125 VAC.
- D. Programmable features:
  1. Time-out period adjustable in increments of 5 minutes from 5 minutes to 1 hour, and in increments of 15 minutes from 1 hour to 12 hours.
  2. Manual override of the preset time-out period. Selecting time scroll UP shall allow time-out period to scroll up throughout the timer possibilities to the maximum. Time scroll DN (down) shall allow time-out period to scroll down to minimum.
  3. One second light flash warning at five minutes before the timer runs out and twice when the countdown reaches one minute (when used to control lighting loads).
  4. Beep warning shall sound every five seconds once the time switch countdown reaches one minute.
  5. Manual timer reset where pressing the ON/OFF switch for more than 2 seconds resets the timer to the programmed time-out period.

### **PART 3 EXECUTION**

#### **3.01 OCCUPANCY SENSOR INSTALLATION**

- A. Install wall mounted occupancy sensors as noted on plan. Arrange occupancy sensors with adjacent switch devices so that device plates line-up and are equally spaced.
- B. Install ceiling mounted sensors at approximate locations as indicated on plan. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.
- C. Locate sensors such that motion through open doors will not falsely activate sensors.
- D. Do not locate ultrasonic sensors within six feet of supply air diffusers.
- E. Locate infrared sensors to avoid obstructions.
- F. Provide the services of a manufacturer's representative for commissioning of occupancy sensor installation. This shall include consultation on layout and location prior to installing sensors, testing of each sensor for compliance with Contract Documents and field adjustment and fine tuning after installation is complete. Provide written confirmation of testing to the Owner, Architect and Engineer.
- G. Field adjustments shall take place in the presence of the owner and the engineer. This shall include owner training on adjustment techniques for the occupancy sensors.

#### **3.02 WIRING INSTALLATION**

- A. Wiring Method: Comply with Division 26 Section "Conductors and Cables".
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. 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.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

#### **3.03 IDENTIFICATION**

- A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
- B. Label time switches and contactors with a unique designation.

#### **3.04 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 actuation of each sensor and adjust time delays.

- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

**3.05 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

**END OF SECTION**

This page intentionally left blank

**SECTION 26 09 43 - LIGHTING CONTROL SYSTEMS**

**PART 1 GENERAL** ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 SUBMITTALS ..... 1  
1.05 QUALITY ASSURANCE ..... 2  
1.06 COORDINATION ..... 2  
1.07 WARRANTY ..... 2  
1.08 EXTRA MATERIALS ..... 3  
1.09 SOFTWARE SERVICE AGREEMENT ..... 3  
1.10 SYSTEM COMMISSIONING ..... 3  
**PART 2 PRODUCTS** ..... 3  
2.01 MANUFACTURERS ..... 3  
2.02 SYSTEM PERFORMANCE REQUIREMENTS ..... 3  
2.03 SYSTEM SOFTWARE INTERFACES ..... 4  
2.04 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT ..... 4  
2.05 WIRED NETWORKED DEVICES ..... 4  
2.06 CONDUCTORS AND CABLES ..... 5  
**PART 3 EXECUTION** ..... 6  
3.01 WIRING INSTALLATION ..... 6  
3.02 INSTALLATION REQUIREMENTS ..... 6  
3.03 SYSTEM STARTUP ..... 6  
3.04 DOCUMENTATION ..... 7  
3.05 FIELD QUALITY CONTROL ..... 7  
3.06 SYSTEM COMMISSIONING ..... 7  
3.07 SOFTWARE INSTALLATION ..... 7  
3.08 ADJUSTING ..... 7  
3.09 DEMONSTRATION ..... 7  
3.10 MANUFACTURER SUPPORT ..... 7

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the design and installation programmable automatic lighting controls with all input and control devices necessary to meet the performance indicated on the contract drawings and this specification
- B. Related Sections include the following:
  - 1. Division 26 Section "Lighting Control Devices" for time switches, photoelectric switches, occupancy sensors, and multi-pole contactors.
  - 2. Division 26 Section "LED Interior Lighting" for luminaire specifications and accessories.

**1.03 DEFINITIONS**

- A. BACnet: A networking communication protocol that complies with ASHRAE 135.
- B. Lon Works: A control network technology platform for designing and implementing interoperable control devices and networks.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
- D. RS-485: A serial network protocol, like RS-232, complying with TIA/EIA-485-A.

**1.04 SUBMITTALS**

- A. Product Data: Indicating general device descriptions, dimensions, electrical specifications, wiring details, and nomenclature for all sensors, relays, dimming modules, control stations and other devices necessary for complete operation of the system
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.

1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements for all system components requiring field installation.
  2. Riser Diagram: Show interconnection between all system components.
    - a. Identify complete data communication backbone and interconnection between sensors, relays, dimming modules control stations and other components.
    - b. Identify typical room/area type configurations.
    - c. Indicate interconnections with emergency egress lighting relays and transfer devices required.
  3. Information Technology (IT) connection: Provide information pertaining to interconnection with facility IT networking equipment and third-party systems.
  4. Other Diagrams and Operational Descriptions – as needed to indicate system operation or interaction with other system(s).
  5. Contractor startup and commissioning worksheet.
- C. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.
- D. Submit qualifications of commissioning agent and draft functional test plans for review and approval.
- E. Field quality-control test reports and commissioning reports at project closeout.
- F. Software licenses and upgrades required by and installed for operation and programming of digital devices.
- G. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals. Include the following:
1. Software manuals.
  2. Operation of adjustable zone controls.
  3. Description of operation and servicing procedures.
  4. List of major components and recommended parts.
  5. System operation and integration instructions.
- H. Warranty: Special warranty specified in this Section.

#### **1.05 QUALITY ASSURANCE**

- A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer with total responsibility for compatibility of lighting control system components specified in this Section.
- 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 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with NFPA 70.
- E. Listed as qualified under Design Lights Consortium (DLC) Networked Lighting Control System Specification V2.0.
- F. System luminaires and controls are certified by manufacturer to have been designed, manufactured and tested for interoperability.
- G. Comply with ASHRAE 90.1 - 2013

#### **1.06 COORDINATION**

- A. Coordinate lighting control components specified in this Section and with systems and components specified in other Sections to form an integrated interconnection of compatible components.
- B. Match components and interconnections for optimum performance of lighting control functions.
- C. Coordinate lighting controls with devices specified in Division 26 Section "Lighting Control Devices".

#### **1.07 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.



### 1.08 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. Batteries for all sensors and switches: Quantity equal to 10% percent of each type and size, but no fewer than 3 of each type and size.

### 1.09 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for five years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.
  - 1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment, if necessary.

### 1.10 SYSTEM COMMISSIONING

- A. Provide the services of a third party, independent agent to perform functional testing and verification of the lighting control system to comply with the requirements of ASHRAE 90.1 – 2013.
- B. Perform functional testing of all lighting control system operations.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acuity nLight Air.
  - 2. Lutron Vive.
  - 3. WaveLinx – Eaton.

### 2.02 SYSTEM PERFORMANCE REQUIREMENTS

- A. System Architecture
  - 1. System shall have an architecture that is based upon three main concepts: (a) networkable intelligent lighting control devices, (b) standalone lighting control zones using distributed intelligence, (c) system backbone for remote, time based and global operation between control zones.
    - a. Intelligent lighting control devices shall have individually addressable network communication capability and consist of one or more basic lighting control components: occupancy sensor, photocell sensor, relay, dimming output, contact closure input, analog 0-10V input, and manual wall station capable of indicating switching, dimming, and/or scene control. Combining one or more of these components into a single device enclosure shall be permissible to minimize overall device count of system.
    - b. Lighting control zones consisting of one or more networked luminaires and intelligent lighting control devices and shall be capable of providing automatic control from sensors (occupancy and/or photocell) and manual control from local wall stations without requiring connection to a higher-level system backbone; this capability is referred to as “distributed intelligence.”
    - c. System must be capable of interfacing directly with networked luminaires such that either low voltage network cabling or wireless RF communication is used to interconnect networked luminaires with control components such as sensors, switches and system backbone.
  - 2. The system shall provide individually addressable switching and dimming control of the following: networked luminaires, control zones to include multiple switch legs or circuits, and relay and dimming outputs from centralized panels to provide design flexibility appropriate with sequence of operations required in each project area or typical space type. A single platform shall be used for both indoor and outdoor lighting controls.
  - 3. Lighting control zones shall be networked with a higher-level system backbone to provide time-based control, remote control from inputs and/or systems external to the control zone, and remote configuration and monitoring through a software.
  - 4. All system devices shall support remote firmware update, such that physical access to each device is not necessary, for purposes of upgrading functionality later.
  - 5. System shall be capable of “out of box” sequence of operation for each control zone. Standard sequence is:
    - a. All switches control all fixtures in a zone
    - b. All occupancy sensors automatically control all fixtures in the control zone with a default timeout.
- B. Wired Networked Control Zone Characteristics

1. All networked devices connected with low voltage network cable shall automatically form a functional lighting control zone without requiring any type of programming, regardless of the programming mechanism (e.g., software application, handheld remote, pushbutton). The "out of box" default sequence of operation is intended to provide typical sequence of operation to minimize the system startup and programming requirements and to also have functional lighting control operation prior to system startup and programming.
2. System shall be able to automatically discover all connected devices without requiring any provisioning of system or zone addresses.
3. The following types of wired networked control devices shall be provided for egress and/or emergency light fixtures:
  - a. Low-Voltage power sensing: These devices shall automatically provide 100% light level upon detection of loss of power sensed via the low voltage network cable connection.
  - b. UL924 Listed Line-Voltage power sensing: These devices shall be listed as emergency relays under the UL924 standard and shall automatically close the load control relay(s) and provide 100% light output upon detection of loss of power sensed via line voltage connections.
  - c. Emergency egress devices shall be provided, and UL labeled by the lighting control manufacturer.

### **2.03 SYSTEM SOFTWARE INTERFACES**

- A. Management Interface
  1. System shall provide a web-based management interface that provides remote system control, live status monitoring, and configuration capabilities of lighting control settings and schedules.
  2. Management interface must be compatible with industry-standard web browser clients, including, but not limited to, Microsoft Internet Explorer®, Apple Safari®, Google Chrome®, Mozilla Firefox®.
  3. All system software updates must be available for automatic download and installation via the internet.
- B. Portable Programming Interface for Standalone Control Zones
  1. Portable handheld application interface for standalone control zones shall be provided for systems that allows configuration of lighting control settings.
  2. Programming capabilities through the application shall include, but not be limited to, the following:
    - a. Switch, occupancy and photo sensor group configuration.
    - b. Manual/automatic on modes.
    - c. Turn-on dim level.
    - d. Occupancy sensor time delays.
    - e. Dual technology occupancy sensors sensitivity.
    - f. Photo-sensor calibration adjustment and auto-setpoint.

### **2.04 SYSTEM BACKBONE AND SYSTEM INTEGRATION EQUIPMENT**

- A. System Controller
  1. System Controller shall be a multi-tasking, real-time digital control processor consisting of modular hardware with plug-in enclosed processors, communication controllers, and power supplies.
  2. System Controller shall perform the following functions:
    - a. Facilitation of global network communication between different areas and control zones.
    - b. Time-based control of downstream wired and wireless network devices.
    - c. Linking into an Ethernet network.
    - d. Integration with Building Management Systems (BMS) and Heating, Ventilation and Air Conditioning (HVAC) equipment.
    - e. Connection to various software interfaces, including management interface, historical database and analytics interface, visualization interface, and personal control applications.
  3. System Controller shall not require a dedicated PC or a dedicated cloud connection.
  4. Device shall automatically detect all networked devices connected to it, including those connected to wired and wireless communication bridges.
  5. Device shall have a standard and astronomical internal time clock.

### **2.05 WIRED NETWORKED DEVICES**

- A. Wired Networked Wall Switches, Dimmers, Scene Controllers
  1. Wall switches & dimmers shall support the following device options:
    - a. Number of control zones: 1, 2 or 4. Gang multiple switches where more than 4 control zones are required in a single location under a single faceplate.
    - b. Control Types Supported: On/Off or On/Off/Dimming
  2. Match color specified in Division 26 Section "Wiring Devices."
  3. Wall Plates:

- a. Single and multi-gang plates as specified in Division 26 Section "Wiring Devices."
  - b. Where multiple switches and/or dimmers are adjacent to each other, install a single cover plate. Provide separate boxes or barriers as required for the application.
  - c. Provide cover plates that are identical in material and dimension to standard single and double gang switch plates.
  - d. Verify back box requirements for multiple control points with manufacturer.
4. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.
- B. Wired Networked Auxiliary Input / Output (I/O) Devices
1. Auxiliary Input/output Devices shall be specified as an input or output device with the following options:
    - a. Contact closure input: Programmable to support maintained or momentary inputs that can activate local or global scenes and profiles, ramp light level up or down, or toggle lights on/off.
    - b. 0-10V analog input: Programmable to function as a daylight sensor.
    - c. RS-232/RS-485 digital input: Supports activation of up to 4 local or global scenes and profiles, and on/off/dimming control of up to 16 local control zones.
    - d. 0-10V dimming control output, capable of sinking a minimum of 20mA of current programmable to support all standard sequence of operations supported by system.
- C. Wired Networked Occupancy and Photosensors
1. Sensors shall utilize passive infrared (PIR) or passive dual technology (PDT) to detect both major and minor motion as defined by NEMA WD-7 standard.
  2. Sensing technologies that are acoustically passive, meaning they do not transmit sound waves of any frequency do not require additional commissioning. Ultrasonic or Microwave based sensing technologies may require commissioning due to the active nature of their technology, if factory required.
  3. Sensor programming parameter shall be available and configurable remotely from the software and locally via the device.
  4. Sensor mounting type shall match project design requirements as shown on plans.
    - a. Sensors shall have optional features for photosensor/daylight override, dimming control, and low temperature/high humidity operation.
  5. The system shall support the following types of photocell-based control:
    - a. On/Off: The control zone is automatically turned off if the photocell reading exceeds the defined setpoint and automatically turned on if the photocell reading is below the defined setpoint. A time delay or adaptive setpoint adjustable behavior may be used to prevent the system from exhibiting nuisance on/off switching.
    - b. Continuous Dimming: The control zone automatically adjusts its dimming output in response to photocell readings, such that a minimum light level consisting of both electric light and daylight sources is maintained at the task. The photocell response shall be configurable to adjust the photocell setpoint and dimming rates.
- D. Wired Networked Wall Switch Sensors
1. Wall switches sensors shall support the following device options:
    - a. User Input Control Types Supported: On/Off or On/Off/Dimming
    - b. Occupancy Sensing Technology: PIR only or Dual Tech
    - c. Daylight Sensing Option: Inhibit Photosensor
- E. Wired Networked Embedded Sensors
1. Embedded sensors shall support the following device options:
    - a. Occupancy Sensing technology: PIR only or Dual Tech
    - b. Daylight Sensing Option: Occupancy only, Daylight only, or combination Occupancy/Daylight sensor
- F. Distributed System Power, Switching and Dimming Controls
1. Devices shall incorporate one optional Class 1 relay, optional 0-10 VDC dimming output, and contribute low voltage Class 2 power to the rest of the system.
  2. Device programming parameters shall be available and configurable remotely from the software and locally via the device push-button.
  3. Device shall be plenum rated.
  4. Devices shall be UL Listed for load and load type as specified on the plans.

## 2.06 CONDUCTORS AND CABLES

- A. General: All conductors and cables shall comply with the requirements of Division 26 Section "Conductors and Cables." Where cable is permitted to be installed exposed in ceiling space, provide plenum rated cable.

- B. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG.
- C. Classes 2 and 3 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 22 AWG.
- D. Class 1 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG.
- E. Digital and Multiplexed Signal Cables: As required by system manufacturer. Provide plenum rated cables where installed exposed in ceiling space.

### **PART 3 EXECUTION**

#### **3.01 WIRING INSTALLATION**

- A. The lighting control system shall be installed and connected as shown on the plans and as directed by the manufacturer.
- B. Comply with NECA 1.
- C. Wiring Method: Install wiring in raceways except where installed in accessible ceilings. Comply with Division 26 Sections "Conductors and Cables" and "Raceways and Boxes".
- D. Where cables are installed in finished areas with exposed construction, conceal cables from view. Route at top of structural systems and conceal on top of structural members where possible. Where cable is exposed to view, provide raceway. As an alternative to raceway, provide cable that is factory colored to match exposed ceiling. Submit sample to Architect for approval.
- E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- F. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- G. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- H. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes as per manufacturers' recommendations.
- I. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."
- J. Label each relay with a unique designation.

#### **3.02 INSTALLATION REQUIREMENTS**

- A. Review all required installation and pre-startup procedures with the manufacturer's representative through pre-construction meetings.
- B. Install and connect the networked lighting control system components according to the manufacturer's installation instructions, wiring diagrams, the project submittals, plans and specifications.
- C. Coordination with Owner's IT Network Infrastructure to secure all required network connections to the owner's IT network infrastructure. Provide the owner's representative with all network infrastructure requirements of the networked lighting control system. Provide the manufacturer's representative with all necessary contacts pertaining to the owner's IT infrastructure, to ensure that the system is properly connected and started up.
- D. Verify integration and interoperability scope with the Mechanical Contractor prior to submittal phase and provide all necessary schedules to the Lighting Control manufacturer.

#### **3.03 SYSTEM STARTUP**

- A. Upon completion of installation by the installer, including completion of all required verification and documentation required by the manufacturer, the system shall be started up and programmed by an authorized representative of the manufacturer.
  - 1. Low voltage network cable testing shall be performed prior to system startup at the discretion of the manufacturer.
- B. System start-up and programming shall include:
  - 1. Verifying operational communication to all system devices.
  - 2. Programming the network devices into functional control zones to meet the required sequence of operation.
  - 3. Programming and verifying all sequence of operations.
  - 4. Customization of owner's software interfaces and applications.

- C. Initial start-up and programming are to occur on-site. Additional programming may occur on-site or remotely over the Internet as necessary.

#### **3.04 DOCUMENTATION**

- A. Submit software database file with desired device labels and notes completed.
- B. Document the installed location of all networked devices, including networked luminaires. Provide as-built plan drawing showing device addresses corresponding to locations of installed equipment.

#### **3.05 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components and equipment installation, including connections and assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Test for circuit continuity.
  - 2. Verify that the control module features are operational.
  - 3. Check operation of local override controls.
  - 4. Test system diagnostics by simulating improper operation of several components selected by Architect.

#### **3.06 SYSTEM COMMISSIONING**

- A. Facilitate the functional testing and verification of the lighting control system by an independent, third party commissioning agent.
- B. Perform commissioning in the presence of the Owner's representative.
- C. Submit functional test plan checklist signed by the commissioning agent.

#### **3.07 SOFTWARE INSTALLATION**

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

#### **3.08 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting programming functions and other system parameters and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

#### **3.09 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to program, adjust, operate, and maintain lighting controls.
- B. Demonstration shall be done only after initial system start-up setup has occurred and system is functioning properly.
- C. Demonstration shall consist of a four-hour minimum session.

#### **3.10 MANUFACTURER SUPPORT**

- A. Manufacturer telephone support shall be available at no cost to the Owner during the warranty period and shall include the following:
  - 1. Assistance in solving programming or other application issues pertaining to the control equipment.
  - 2. The manufacturer shall provide a toll-free number for direct technical support available 7 days a week, 24 hours a day.
  - 3. A factory authorized technician shall be located within a 100-mile radius of the project site.

**END OF SECTION**

This page intentionally left blank

**SECTION 26 24 16 - PANELBOARDS**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 SUBMITTALS ..... 1  
1.05 QUALITY ASSURANCE ..... 2  
1.06 PROJECT CONDITIONS ..... 2  
1.07 COORDINATION ..... 2  
1.08 EXTRA MATERIALS ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 MANUFACTURERS ..... 2  
2.02 MANUFACTURED UNITS ..... 2  
2.03 PANELBOARD SHORT-CIRCUIT RATING ..... 3  
2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS ..... 3  
2.05 OVERCURRENT PROTECTIVE DEVICES ..... 3  
2.06 ACCESSORY COMPONENTS AND FEATURES ..... 4  
PART 3 EXECUTION ..... 4  
3.01 INSTALLATION ..... 4  
3.02 IDENTIFICATION ..... 4  
3.03 CONNECTIONS ..... 4  
3.04 FIELD QUALITY CONTROL ..... 4  
3.05 CLEANING ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Lighting and appliance branch-circuit panelboards.

**1.03 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. AFCI: Arc-fault circuit interrupter.
- E. RFI: Radio-frequency interference.
- F. RMS: Root mean square.
- G. SPDT: Single pole, double throw.

**1.04 SUBMITTALS**

- A. Product Data: For each type of panelboard, overcurrent protective device, surge protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Related Submittals:
  - 1. Provide overcurrent device coordination study to demonstrate proper overcurrent device ratings, adjustments, and settings.
- C. 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. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Power, signal, and control wiring.
- D. 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.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1, 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.

### 1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source 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 PB 1.
- D. Comply with NFPA 70.

### 1.06 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.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.
  2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

### 1.07 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.

### 1.08 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. Keys: Six spares for each type of panelboard cabinet lock.

## PART 2 PRODUCTS

### 2.01 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. GE by ABB.
    - c. Siemens Industries, Inc.
    - d. Square D.

### 2.02 MANUFACTURED UNITS

- A. Enclosures: Mounting as noted on panel schedules. NEMA PB 1, Type 1.
  1. Rated for environmental conditions at installed location.
    - a. Outdoor Locations: NEMA 250, Type 3R.



- b. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  2. Cabinet Front: Flush or surface cabinet as noted on the Drawings.
    - a. Eaton LTDD (Piano hinge trim)
    - b. GE – FGB (front hinge to box).
    - c. Square D – Continuous piano hinge trim.
    - d. Siemens – Figure 4 hinge to box w/piano hinge.
  3. Finishes:
    - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.
  4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase and Ground Buses:
  1. Material: Hard-drawn copper, 98 percent conductivity or aluminum.
  2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- C. Conductor Connectors: Suitable for use with conductor material.
  1. Main and Neutral Lugs: Mechanical type.
  2. Ground Lugs and Bus Configured Terminators: Compression type.

### **2.03 PANELBOARD SHORT-CIRCUIT RATING**

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

### **2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS**

- A. Main bus bars, neutral and ground, shall be sized in accordance with U.L. Standards to limit temperature rise on any current carrying part to the maximums as indicated in UL67.
- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

### **2.05 OVERCURRENT PROTECTIVE DEVICES**

- A. Molded-Case Circuit Breaker: NEMA AB 3, 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.
    - a. Circuit Breakers 250A and Larger: Magnetic trip element with front-mounted, field-adjustable trip setting with restricted access cover.
  2. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings with restricted access cover:
    - 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<sup>2</sup>t response.
  3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  4. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
- 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. Do not use tandem circuit breakers.
  5. Provide lock on devices for circuit breakers when called out on panel schedules with "LOD" designation.
  6. Provide type GFEP circuit breakers for all self-regulating heating (snow melting and heat trace) cables branch circuits and where noted on panel schedules with "GFEP" designation
  7. Provide GFCI circuit breaker when called out on panel schedules with "GFCI" designation.
  8. Provide permanent padlockable handle for circuit breakers when called out on panel schedules with "PL" designation.

## **2.06 ACCESSORY COMPONENTS AND FEATURES**

- A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Provide permanent provisions for padlocking overcurrent devices in Branch Circuit Panelboards that serve equipment not provided with a local, lockable disconnecting means. Provisions shall remain in place whether or not lock is installed

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports 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. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

### **3.02 IDENTIFICATION**

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads or created by retrofitting. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Coordinate final directory room names and numbers with Owner.
- C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### **3.03 CONNECTIONS**

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."
- B. Connect wiring according to Division 26 Section "Conductors and Cables."

### **3.04 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: Perform the following field quality control tests in accordance with Division 26 section "Electrical Testing"
  - 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. Perform electrical tests on all breakers and switches 200A and above or that constitute a component of an emergency distribution system. Main circuit breakers in branch circuit panelboards 225A and below are not required to be tested.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  - 1. Measure as directed during period of normal system loading.
  - 2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  - 4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.
  - 1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 2. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### **3.05 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**

This page intentionally left blank

**SECTION 26 27 26 - WIRING DEVICES**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 REFERENCES ..... 1  
1.05 SUBMITTALS ..... 2  
1.06 QUALITY ASSURANCE ..... 2  
1.07 COORDINATION ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 GENERAL WIRING DEVICE REQUIREMENTS ..... 2  
2.02 STANDARD GRADE RECEPTACLES ..... 2  
2.03 GFCI RECEPTACLES ..... 2  
2.04 STRAIGHT BLADE AND TWIST-LOCK RECEPTACLES, OTHER THAN NEMA 5-20R ..... 3  
2.05 CORD AND PLUG SETS ..... 3  
2.06 WALL SWITCHES ..... 3  
2.07 WALL PLATES ..... 3  
PART 3 EXECUTION ..... 4  
3.01 INSTALLATION ..... 4  
3.02 IDENTIFICATION ..... 4  
3.03 CONNECTIONS ..... 4  
3.04 FIELD QUALITY CONTROL ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Single and duplex receptacles
  - 2. Ground-fault circuit interrupter receptacles
  - 3. Single- and double-pole snap switches.
  - 4. Device wall plates.

**1.03 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. AFCI: Arc-fault circuit interrupter.
- D. PVC: Polyvinyl chloride.
- E. RFI: Radio-frequency interference.
- F. SPD: Surge protective devices.
- G. UTP: Unshielded twisted pair.
- H. USB: Universal serial bus.

**1.04 REFERENCES**

- A. DSCC W-C-596G: Federal Specification Connector, Electrical, Power, General Specification.
- B. DSCC W-C-896F: Federal Specification Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
- C. IEC 309-1, Part 1: General Requirements: Plugs, Socket-Outlets and Couplers for Industrial Purposes
- D. NEMA FB 11: Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.
- E. NEMA WD 1: General Requirements for Wiring Devices.
- F. NEMA WD 6: Wiring Device – Dimensional Requirements.
- G. UL 20: General-Use Snap Switches.
- H. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.

- I. UL 486B: Wire Connectors for Use with Aluminum Conductors.
- J. UL 498: Electrical Attachment Plugs and Receptacles.
- K. UL 943: Ground Fault Circuit Interrupters.
- L. NECA 130-2010: Installing and Maintaining Wiring Devices.

#### **1.05 SUBMITTALS**

- A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations for each type of product indicated.

#### **1.06 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of wiring device 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 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.

#### **1.07 COORDINATION**

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL WIRING DEVICE REQUIREMENTS**

- A. Comply with NFPA 70, NEMA WD 1, NEMA WD 6, and UL498.
- B. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- C. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wall Switches: White, unless otherwise indicated.

#### **2.02 STANDARD GRADE RECEPTACLES**

- A. Tamper-Resistant Duplex Receptacle, NEMA 5-20R:
  - 1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Wiring Device-Kellems: 5362TR
    - b. Eaton/Arrow Hart Wiring Devices: AHTR5362
    - c. Leviton: 5362-SG
    - d. Legrand, Pass & Seymour: TR5362
- B. Weather- and Tamper-Resistant Duplex Receptacle, NEMA 5-20R:
  - 1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Hubbell Wire Device-Kellems: BR20WRTR
    - b. Eaton/Arrow Hart Wiring Devices: TWRBR20
    - c. Leviton: TWR20
    - d. Legrand, Pass & Seymour: WR5352TR

#### **2.03 GFCI RECEPTACLES**

- A. General:
  - 1. Comply with UL 943
- B. Tamper-Resistant Duplex GFCI Receptacle, NEMA 5-20R:
  - 1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
  - 2. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell Wiring Device-Kellems: GFTRST20
    - b. Eaton/Arrow Hart Wiring Devices: TRSGF20
    - c. Leviton: GFTR2

- d. Legrand, Pass & Seymour: 2097TR
- C. Tamper- and Weather-Resistant Duplex GFCI Receptacle, NEMA 5-20R:
  - 1. Safety mechanism to energize contacts only when both openings are simultaneously engaged.
  - 2. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell Wiring Device-Kellems: GFTWRST20
    - b. Eaton/Arrow Hart Wiring Devices: TWRSGF20
    - c. Leviton: GFWT2
    - d. Legrand, Pass & Seymour: 2097TRWR
- A. Dead Front GFCI, 20A:
  - 1. Manufacturers: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell Wiring Device-Kellems: GFBFST20
    - b. Eaton/Arrow Hart Wiring Devices: SGF20
    - c. Leviton: GFRBF
    - d. Legrand, Pass & Seymour: 2087

#### **2.04 STRAIGHT BLADE AND TWIST-LOCK RECEPTACLES, OTHER THAN NEMA 5-20R**

- A. Provide commercial specification grade straight blade and twist-lock receptacles with standard NEMA configurations.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Wiring Device-Kellems
  - 2. Eaton/Arrow Hart Wiring Devices
  - 3. Leviton
  - 4. Legrand, Pass & Seymour

#### **2.05 CORD AND PLUG SETS**

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. 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.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

#### **2.06 WALL SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Wiring Device-Kellems: 1220 Series
  - 2. Eaton/Arrow Hart Wiring Devices: AH1220 Series
  - 3. Leviton: 1220 Series
  - 4. Legrand, Pass & Seymour: PS20AC Series
- B. Device body: Plastic handle.
- C. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.
- D. Snap Switches: Heavy Duty specification grade, quiet type; rated 20A., 120-277 V AC.
- E. Provide single-pole, two-pole, three-way and four-way switches as indicated.
- F. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.
  - 1. Switch: 20 A, 120/277-V ac.
  - 2. Receptacle: NEMA WD 6, Configuration 5-20R.

#### **2.07 WALL PLATES**

- A. Manufacturers:
  - 1. Provide wall plates and corresponding wiring devices from same manufacturer.
- B. 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:
    - a. 0.035-inch- thick, satin-finished stainless steel
  - 3. Material for Unfinished Spaces:
    - a. Galvanized steel
  - 4. Material for Wet Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Extra Duty Weatherproof While-In-Use.

- a. Manufacturers:
  - 1) Hubbell: MX3200
  - 2) Red Dot Model: CKLSVU, Thomas & Betts
  - 3) Intermatic: WP3110MXD
  - 4) Leviton: IUM1V
5. Material for Damp Locations: Gasketed Cast aluminum with hinged cover and listed and labeled as Weatherproof.
  - a. Manufacturers:
    - 1) Red Dot Model CCGV, ABB Installation Products
    - 2) Eaton/Arrow Hart WLRD1
    - 3) Legrand, Pass & Seymour
    - 4) Intermatic: WP3110MXD

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install products in accordance with manufacturer's instructions.
- B. Prior to installation of devices, verify wall openings are neatly cut and will be completely covered by wall plates, clean debris from outlet boxes and provide extension rings to bring outlet boxes flush with finished surface.
- C. Install devices and assemblies level, plumb, and square with building lines.
- D. Arrangement of Devices:
  1. Coordinate locations of outlet boxes provided under Division 26 Section "Raceways and Boxes" to obtain mounting heights indicated on Drawings.
  2. Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top.
  3. Where multiple switches, dimmers, and/or occupancy sensors are adjacent to each other, provide a single cover plate. Custom fabricate, if required, for all combinations. Provide separate boxes or barriers as required for the application.
  4. Install horizontally mounted receptacles with grounding pole on the left.
  5. Install GFCI receptacles so that the "Push To Test" and "Reset" designations can be read correctly. If printed in both directions, install with ground pole on top.
  6. Install switches with OFF position down.
- E. Install cover plates on switch, receptacle, and blank outlets in finished areas.
- F. Install weather-resistant type receptacles in all damp and wet locations, including pool environments.
- G. Install weatherproof cover plates on receptacles in damp locations.
- H. Install weatherproof While-In-Use cover plates on receptacles in wet locations.
- I. Install tamper-resistant type receptacles in all locations.
- J. Use oversized plates for outlets installed in masonry walls.
- K. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.
- L. Remove wall plates and protect devices and assemblies during painting.
- M. Adjust devices and wall plates to be flush and level. Three corners of wall plates must be in contact with wall surfaces. Devices shall be solidly mounted against the box.

### **3.02 IDENTIFICATION**

- A. Comply with Division 26 Section "Electrical Identification."
  1. Receptacles: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section "Electrical Identification" with black-filled lettering on face of wall plate, and durable wire markers or tags inside outlet boxes.
  2. Wall Switches: Identify panelboard and circuit number from which served. Use adhesive label as specified in Division 26 Section "Electrical Identification" with black-filled lettering on back side of wall plate, and durable wire markers or tags inside outlet boxes.

### **3.03 CONNECTIONS**

- A. Ground equipment according to Division 26 Section "Grounding and Bonding." Connect wiring device grounding terminal to outlet box with bonding jumper. Use of quick ground strap or screw is not acceptable.



- B. Connect wiring according to Division 26 Section "Conductors and Cables." Connect wiring devices by wrapping conductor around screw terminal or by using back wiring and tightening the screw securely.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

#### **3.04 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Inspect each wiring device for defects.
  - 2. Operate each wall switch with circuit energized and verify proper operation.
  - 3. After installing wiring devices and after electrical circuitry has been energized, test each receptacle for proper polarity, ground continuity, and compliance with requirements.
  - 4. Test each GFCI receptacle for proper operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

**END OF SECTION**

This page intentionally left blank

**SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 REFERENCES ..... 1  
1.05 SUBMITTALS ..... 2  
1.06 QUALITY ASSURANCE ..... 2  
1.07 COORDINATION ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 MANUFACTURERS ..... 2  
2.02 NONFUSIBLE SWITCHES ..... 2  
2.03 TOGGLE DISCONNECT SWITCH ..... 2  
2.04 MOLDED-CASE CIRCUIT BREAKERS ..... 3  
2.05 ENCLOSURES ..... 3  
PART 3 EXECUTION ..... 3  
3.01 EXAMINATION ..... 3  
3.02 INSTALLATION ..... 3  
3.03 IDENTIFICATION ..... 4  
3.04 FIELD QUALITY CONTROL ..... 4  
3.05 ADJUSTING ..... 4  
3.06 CLEANING ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following individually mounted, enclosed switches and circuit breakers:
  - 1. Nonfusible switches.
  - 2. Molded-case circuit breakers.
  - 3. Enclosures.
- B. Related Sections:
  - 1. Division 26 "Hangers and Supports for Electrical Systems" for concrete bases.

**1.03 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.

**1.04 REFERENCES**

- A. NECA 1: Practices for Good Workmanship in Electrical Contracting.
- B. NETA ATS: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- C. NEMA 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
- D. NEMA AB 1: Molded Case Circuit Breakers and Molded Case Switches.
- E. NEMA FU 1: Low Voltage Cartridge Fuses.
- F. NEMA KS 1: Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
- G. NEMA PB1.1: General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.
- H. NEMA PB2.1: General Instructions for Proper Installation, Operation, and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
- I. NFPA 70: National Electrical Code.

### 1.05 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. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. 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.
- D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

### 1.06 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.

### 1.07 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

### 2.01 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.

### 2.02 NONFUSIBLE SWITCHES

- A. Manufacturers:
  - 1. Eaton Corporation; Cutler-Hammer Products.
  - 2. General Electric Co.; Electrical Distribution & Control Division.
  - 3. Siemens Industries, Inc.
  - 4. Square D/Group Schneider.
- B. NEMA KS 1, quick make, quick-break load interrupter enclosed knife switch Type HD, externally operable lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Provide early break auxiliary contacts in motor disconnect switches for motors that are fed from variable frequency controllers.
  - 2. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 3. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
  - 4. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

### 2.03 TOGGLE DISCONNECT SWITCH

- A. Manufacturers:
  - 1. Double Pole:
    - a. Hubbell 1372.
    - b. Leviton 6808G-DAC.
    - c. Pass & Seymour 7812.

- d. Bryant 30102.
- 2. Three Pole:
  - a. Hubbell 1379.
  - b. Leviton 7810GD.
  - c. Pass & Seymour 7813.
  - d. Bryant 30103.

B. Description: Heavy duty, 30A, 600 volt, double or three pole as required, single throw, motor rated switch without overload protection. Provide NEMA 1 enclosure and padlock attachment.

#### **2.04 MOLDED-CASE CIRCUIT BREAKERS**

- A. Manufacturers:
  - 1. Eaton Corporation; Cutler-Hammer Products.
  - 2. General Electric Co.; Electrical Distribution & Control Division.
  - 3. Siemens Industries, Inc.
  - 4. 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<sup>2</sup>t response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
  - 5. GFCI Circuit Breakers: Single- and two-pole configurations with 5 or 30-mA trip sensitivity as required.
- C. 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 material.
  - 2. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  - 3. Enclosure: Provide handle capable of being locked in the open position with padlock.
  - 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.

#### **2.05 ENCLOSURES**

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Indoor Dry Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  - 4. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

### **PART 3 EXECUTION**

#### **3.01 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.

#### **3.02 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. Install switches with off position down.

- D. Install NEMA KS 1 enclosed switch where indicated for motor loads  $\frac{1}{2}$  HP and larger and equipment loads greater than 30A.
- E. Install toggle disconnect switch, surface mounted, where indicated for motor loads less than  $\frac{1}{2}$  HP and equipment loads 30A. and less.
- F. Install flexible liquid tight conduit from toggle disconnect switch to portable equipment. Leave a 6'-0" (1.8m) whip.
- G. Install flexible liquid tight conduit from toggle disconnect switch to stationary equipment.
- H. Install equipment on exterior foundation walls at least one inch (25 mm) from wall to permit vertical flow of air behind breaker and switch enclosures.
- I. Support enclosures independent of connecting conduit or raceway system.
- J. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

### 3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Electrical Identification."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Electrical Identification."
- C. Provide adhesive label as specified in Division 26 Section "Electrical Identification" on inside door of each switch indicating UL fuse class and size for replacement.

### 3.04 FIELD QUALITY CONTROL

- A. Prepare for acceptance testing as follows:
  - 1. Inspect mechanical and electrical connections.
  - 2. Verify switch and relay type and labeling verification.
- B. 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. 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.

### 3.05 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip and time delay settings to values as determined by the protective device coordination study.

### 3.06 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 29 13 - ENCLOSED CONTROLLERS**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 SUBMITTALS ..... 1  
1.04 REFERENCES ..... 2  
1.05 QUALITY ASSURANCE ..... 2  
1.06 DELIVERY, STORAGE, AND HANDLING ..... 2  
1.07 PROJECT RECORD DOCUMENTS ..... 2  
1.08 PROJECT CONDITIONS ..... 2  
1.09 COORDINATION ..... 2  
PART 2 PRODUCTS ..... 2  
2.01 MANUFACTURERS ..... 2  
2.02 ACROSS-THE-LINE ENCLOSED CONTROLLERS ..... 3  
2.03 ENCLOSURES ..... 3  
2.04 ACCESSORIES ..... 3  
2.05 FACTORY FINISHES ..... 3  
PART 3 EXECUTION ..... 3  
3.01 EXAMINATION ..... 3  
3.02 APPLICATIONS ..... 3  
3.03 INSTALLATION ..... 3  
3.04 IDENTIFICATION ..... 4  
3.05 CONTROL WIRING INSTALLATION ..... 4  
3.06 CONNECTIONS ..... 4  
3.07 FIELD QUALITY CONTROL ..... 4  
3.08 ADJUSTING ..... 4  
3.09 DEMONSTRATION ..... 4

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes ac, enclosed controllers rated 600 V and less, of the following types:
  - 1. Across-the-line, manual and magnetic controllers.

**1.03 SUBMITTALS**

- A. Product Data: For each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each enclosed controller.
  - 1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Each installed unit's type and details.
    - b. Nameplate legends.
    - c. Short-circuit current rating of integrated unit.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For enclosed controllers to include operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Routine maintenance requirements for enclosed controllers and all installed components.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- E. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

#### **1.04 REFERENCES**

- A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
- B. ANSI/UL 198C - High-Intensity Capacity Fuses; Current-Limiting Types.
- C. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service.
- D. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted.
- E. NECA 402-2000 – Recommended Practice for Installing and Maintaining Motor Control Centers.
- F. NEMA AB 1 - Molded Case Circuit Breakers.
- G. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
- H. NEMA KS 1 - Enclosed Switches.
- I. ANSI/NFPA 70 - National Electrical Code.

#### **1.05 QUALITY ASSURANCE**

- A. Source Limitations: Obtain enclosed controllers of a single type through one source 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 NFPA 70.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site under provisions of Section 26 00 10. Store and protect products under provisions of Section 26 00 10.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle in accordance with manufacturer's written instructions. Lift large equipment only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.
- D. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

#### **1.07 PROJECT RECORD DOCUMENTS**

- A. Accurately record actual locations of each contactor and indicate circuits controlled. Submit under provisions of 26 0010.

#### **1.08 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 no fewer than seven days in advance of proposed interruption of electrical service.
  - 2. Indicate method of providing temporary utilities.
  - 3. Do not proceed with interruption of electrical service without Construction Manager's written permission.

#### **1.09 COORDINATION**

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
  - 2. Danfoss Inc.; Danfoss Electronic Drives Div.



3. Eaton Corporation; Cutler-Hammer Products.
4. General Electrical Company; GE Industrial Systems.
5. Rockwell Automation; Allen-Bradley Co.; Industrial Control Group.
6. Siemens/Furnas Controls.
7. Square D.

## **2.02 ACROSS-THE-LINE ENCLOSED CONTROLLERS**

- A. Combination Magnetic Controller: Factory-assembled combination controller and disconnect switch.
  1. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
  2. Circuit-Breaker Disconnecting Means: NEMA AB 1, motor-circuit protector with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

## **2.03 ENCLOSURES**

- A. Description: Surface-mounting cabinets. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at 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.

## **2.04 ACCESSORIES**

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Indicating Lights: Run (Red), off or ready (Green).
- C. Auxiliary Contacts: Provide two normally open (N.O.) and two normally closed (N.C.) contacts.
- D. Selector Switch: NEMA ISC 2, mounted in front cover to read "hand/off/auto," provide auxiliary contact for auto position monitoring.
- E. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.
- F. Manufacturer provided nameplate shall be provided on controller enclosure. Nameplate shall contain the following information:
  1. Manufacturer's name or identification.
  2. Voltage rating.
  3. Current and/or horsepower rating.
  4. Short-circuit current rating,

## **2.05 FACTORY FINISHES**

- A. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1)

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and surfaces to receive enclosed controllers for compliance with requirements, installation tolerances, and other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 APPLICATIONS**

- A. Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, controller, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.

### **3.03 INSTALLATION**

- A. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."
- B. Install motor control equipment and contactors in accordance with manufacturer's instructions.

- C. Select and install heater elements in motor starters to match installed motor characteristics.
- D. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

### **3.04 IDENTIFICATION**

- A. Identify enclosed controller, components, and control wiring according to Division 26 Section "Electrical Identification."

### **3.05 CONTROL WIRING INSTALLATION**

- A. Install wiring between enclosed controllers according to Division 26 Section "Conductors and Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect hand-off-automatic switch and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.
  - 2. Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### **3.06 CONNECTIONS**

- A. Ground equipment according to Division 26 Section "Grounding and Bonding."

### **3.07 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each enclosed controller element, bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
  - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### **3.08 ADJUSTING**

- A. Set field-adjustable switches and circuit-breaker trip ranges.

### **3.09 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers. Refer to Division 1 Section "Demonstration and Training."

**END OF SECTION**

**SECTION 26 51 19 - LED INTERIOR LIGHTING**

PART 1 GENERAL ..... 1  
1.01 RELATED DOCUMENTS ..... 1  
1.02 SUMMARY ..... 1  
1.03 DEFINITIONS ..... 1  
1.04 SUBMITTALS ..... 1  
1.05 CLOSEOUT SUBMITTALS ..... 2  
1.06 QUALITY ASSURANCE ..... 2  
1.07 DELIVERY, STORAGE, AND HANDLING ..... 2  
1.08 COORDINATION ..... 2  
1.09 WARRANTY ..... 2  
PART 2 PRODUCTS ..... 3  
2.01 PERFORMANCE REQUIREMENTS ..... 3  
2.02 LUMINAIRES (LIGHTING FIXTURES) ..... 3  
2.03 LUMINAIRE REQUIREMENTS ..... 3  
2.04 EXIT SIGNS ..... 3  
2.05 MATERIALS ..... 3  
2.06 METAL FINISHES ..... 4  
2.07 LUMINAIRE FIXTURE SUPPORT COMPONENTS ..... 4  
PART 3 EXECUTION ..... 4  
3.01 EXAMINATION ..... 4  
3.02 TEMPORARY LIGHTING ..... 4  
3.03 INSTALLATION ..... 4  
3.04 CONNECTIONS ..... 4  
3.05 IDENTIFICATION ..... 4  
3.06 FIELD QUALITY CONTROL ..... 5  
3.07 ADJUSTING ..... 5  
3.08 CLEANING ..... 5

**PART 1 GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.
- B. Related Requirements:
  - 1. Division 26 "Lighting Control Devices."
  - 2. Division 26 "Dimming Controls"

**1.03 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lamp: LED and substrate as a replaceable assembly.
- F. LED: Light-emitting diode.
- G. Lumen: Measured output of lamp and luminaire, or both.
- H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

**1.04 SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.

4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project per IES LM-79 and IES LM-80.
  - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products or certified by a qualified independent testing agency.
- B. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Lighting luminaires.
  2. Suspended ceiling components.
  3. Initial access modules for acoustical tile, including size and locations.
  4. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Access panels.
- C. Qualification Data: For testing laboratory providing photometric data for luminaires.
- D. Sample warranty.

#### **1.05 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### **1.06 QUALITY ASSURANCE**

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- 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:
  1. NFPA 70 - National Electrical Code.
  2. NECA/IESNA 500-1998 – Recommended Practice for Installing Indoor Commercial Lighting Systems.
  3. NECA/IESNA 502-1999 – Recommended Practice for Installing Industrial Lighting Systems.
  4. Code of Federal Regulations (47 CFR 37342).
  5. Michigan Department of Community Industry Services requirements that all lamps shall be protected from breakage. Exposed lamps are not acceptable.
- G. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### **1.08 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.

#### **1.09 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

- B. Warranty Period: Five year(s) or manufacturer's standard warranty length (whichever is longer) from date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

### **2.02 LUMINAIRES (LIGHTING FIXTURES)**

- A. Provide Luminaires as included in the luminaire schedule shown on drawings.
- B. Acceptable alternate manufacturers are indicated on the luminaire schedule. Alternate manufacturer products shall be equal in all respects including materials, finishes, photometric performance and energy performance and shall include all options, features, and accessories identified.

### **2.03 LUMINAIRE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Unless otherwise specified in Luminaire product data, provide products with an IES LM-80 rated lamp life of 50,000 hours.
- D. Driver
  - 1. Provided as an integrated component of the luminaire or as an external component of an assembly of luminaires.
  - 2. Nominal Input Voltage: All drivers shall be rated for use on either 120V or 277V systems.

### **2.04 EXIT SIGNS**

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
  - 1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
  - 2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  - 3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
- D. Provide edge lit signs with a mirror plaque background.

### **2.05 MATERIALS**

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
  - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Factory-Applied Labels: Comply with UL 1598 Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

## **2.06 METAL FINISHES**

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## **2.07 LUMINAIRE FIXTURE SUPPORT COMPONENTS**

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 TEMPORARY LIGHTING**

- A. Do not use permanent luminaires for temporary lighting.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and N.E.C.A./I.E.S.N.A. 500-2006 and 502-2006.
- B. Locate ceiling luminaires as indicated on reflected ceiling plan.
- C. Install recessed luminaires to permit removal from below.
- D. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- E. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- F. Install fixture with no gaps between adjacent fixtures or between fixtures and surrounding surfaces. Trims of fixtures shall be properly and uniformly aligned.
- G. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- H. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
  - 2. Do not attach luminaires directly to gypsum board.
- I. Comply with requirements in Section 26 05 19 "Conductors and Cables" for wiring connections.
- J. Fixtures shall have their exterior labels removed and shall be thoroughly cleaned.
- K. Locate the remote test/monitor modules identically so that they are visible and they form a straight line when viewed from the end of the corridor or room. Where a suspended ceiling exists, center the modules in adjacent ceiling tiles.

### **3.04 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 wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- C. Bond products and metal accessories to branch circuit equipment grounding conductor.
- D. Connect luminaires to branch circuit outlet boxes provided under Division 26 Section "Raceways and Boxes" using 1/2" flexible conduit.

### **3.05 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### **3.06 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.
- D. A visual inspection shall be performed 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.

### **3.07 ADJUSTING**

- A. Adjust exit sign directional arrows as indicated on Drawings.
- B. Adjust and calibrate all dimming system controls until the system works as designed. Contact the Architect/Engineer when dimming is complete and demonstrate operation to owner's representative and Architect/Engineer.

### **3.08 CLEANING**

- A. Clean electrical parts to remove conductive and deleterious materials.
- B. Remove dirt and debris from enclosures and lenses.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

**END OF SECTION**

This page intentionally left blank



**SECTION 27 0143  
 COMMUNICATIONS UNIT PRICE SHEET**

NOTE: Unit costs are to be included with bidder's original proposal for the Work to be done per Project Specifications. All unit costs shall include installation labor unless otherwise noted.

Project Name: \_\_\_\_\_

Name of Bidder: \_\_\_\_\_

Unit prices are valid for 365 days. Date Negotiated: \_\_\_\_\_

<b>UP-#</b>	<b>Item or Material</b>	<b>Unit Price</b>
<b>UP-1</b>	Provide one (1) Category 6 data drop including cable, jacks at both ends, faceplate, terminations, testing, and documentation, as specified (200 foot average)	\$
<b>UP-2</b>	Provide two (2) Category 6 data drops including cable, jacks at both ends, faceplate, terminations, testing, and documentation, as specified (200 foot average)	\$
<b>UP-3</b>	Provide one (1) 48-port Category 6 modular patch panel, unloaded, as specified	\$
<b>UP-4</b>	Provide one (1) Single-mode fiber optic patch cable, as specified	\$
<b>UP-5</b>	Provide one (1) Category 6 six inch (6") 28 AWG patch cable, as specified	\$
<b>UP-6</b>	Provide one (1) Category 6 one foot (1') 28 AWG patch cable as specified	\$
<b>UP-7</b>	Provide one (1) Category 6 three foot (3') 23 AWG patch cable, as specified	\$
<b>UP-8</b>	Provide one (1) Category 6 five foot (5') 23 AWG patch cable, as specified	\$
<b>UP-9</b>	Provide one (1) Category 6 ten foot (10') 23 AWG patch cable, as specified	\$
<b>UP-10</b>	Provide one (1) one inch (1") conduit sleeve through CMU wall including bushings, firestop both sides and around the perimeter of the conduit	\$
<b>UP-11</b>	Provide one (1) two inch (2") conduit sleeve through CMU wall including bushings, firestop both sides and around the perimeter of the conduit	\$
<b>UP-12</b>	Provide per foot cost for 12-strand single-mode cable, installed, but not terminated or tested. This would be used if the length of the fiber cable varies due to the route.	\$
<b>UP-13</b>	Cabling Technician (Hourly Rate)	\$
<b>UP-14</b>	Cabling Technician (Overtime Hourly Rate)	\$
<b>UP-15</b>	Cabling Technician (Holiday Hourly Rate)	\$

**END OF SECTION**

**SECTION 27 1116  
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This section includes the minimum requirements for the installation of communications cabinets within the communications closets.
- B. This section includes, but is not limited to the following:
  - 1. Wall mount cabinets
- C. Provide all labor, materials, and equipment for the completion of work called for in the Contract Documents.
- D. The Contractor shall be responsible for providing the services necessary to furnish, configure, deliver, install, integrate, and test all specified equipment. All work shall be in accordance with the intent of these specifications, and as required to leave the infrastructure components complete and in manufacturer certified operating conditions, excluding those items listed under "Work by Others."
- E. The Contractor shall provide any additional items, not specifically mentioned herein or on the drawings, necessary to meet system requirements as specified, without claim for additional payment.
- F. Errors or Omissions in Drawings or Documentation
  - 1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.
  - 2. Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.
- G. Related Sections:
  - 1. Section 27 13 23 Communications Optical Fiber Backbone Cabling
  - 2. Section 27 15 13 Communications Copper Horizontal Cabling

**1.03 DEFINITIONS**

- A. ANSI – American Northern Standards Institute
- B. BICSI – Building Industry Consulting Service International
- C. EIA – Electronics Industry Alliance
- D. IEEE – Institute of Electrical and Electronic Engineers
- E. ISO – International Standards Organization
- F. NECA – National Electrical Contractors Association
- G. NFPA – National Fire Protection Agency
- H. TIA – Telecommunications Industry Association
- I. UL – Underwriters Laboratory
- J. UTP - Unshielded Twisted Pair

- K. FO - Fiber Optic
- L. Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.
- M. Main Distribution Frame (MDF): This technology space houses main network distribution equipment and acts as the main connection point between the Core/Network and the TR/IDF/access zones for all connections.
- N. Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access-layer switches and user network connections within each floor.
- O. Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.
- P. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.
- Q. Cabinet: free standing, floor-mounted or wall-mounted modular enclosure designed to house and protect rack-mounted electronic equipment and passive terminations; usually referred to as an equipment cabinet.
- R. Rack: An open, freestanding, floor-mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.
- S. Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross-connect fields.
- T. Bonding: permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.
- U. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
- V. Patch Cords: a length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross-connect.
- W. Pathway: facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, under floor systems, overhead systems, raised floor, ceiling support wires, etc.

#### 1.04 QUALITY ASSURANCE

- A. The system will adhere to the most current applicable rulings of the Federal Communications Commission (FCC). Provide the FCC registration number with the equipment submittal. All components and installations shall bear an Underwriters' Laboratories (UL) listing and shall conform with the latest edition or revision of the following codes and standards:
  - 1. ANSI American National Standards Institute
  - 2. ASTM American Society for Testing and Materials
  - 3. BICSI Building Industry Consulting Service International
  - 4. CSI Construction Specifications Institute
  - 5. EIA Electronics Industries Alliance
  - 6. FCC Federal Communications Commission
  - 7. ICEA Insulated Cable Engineers Association
  - 8. IEC International Electro Technical Commission
  - 9. IEEE Institute of Electrical and Electronics Engineers
  - 10. ISO International Organization for Standardization

- 
11. NEC National Electrical Code
  12. NEMA National Electrical Manufacturer's Association
  13. NFPA National Fire Protection Association.
  14. TIA Telecommunications Industry Association
  15. UL Underwriters Laboratories, Inc.
- B. The code or standard establishing the more stringent requirements shall be followed where areas of conflict occur between codes and standards or between codes and standards and drawings and specifications.
- C. References:
1. BICSI Telecommunications Distribution Methods Manual, 14<sup>th</sup> Edition
  2. BICSI Cabling Installation Manual
  3. CSI Master Format 2016 Edition – Division 27 - Communications
  4. ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard
  5. ANSI/TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standard
  6. ANSI/TIA-568.3-D – Optical Fiber Cabling and Components Standard
  7. ANSI/TIA-569-E – Telecommunications Pathways and Spaces
  8. ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure
  9. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
  10. ISO/IEC 11801 – Information Technology – General Cabling for Customer Premises
  11. ISO/IEC 11801 – Information Technology – Pathways and Spaces for Customer Premises Cabling
  12. NFPA 70, NEC and NFPA 255
  13. UL Cable Verifications Program
  14. UL Testing Bulletin
  15. All materials shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar systems for a minimum of five (5) years.
- D. All materials shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar systems for a minimum of five (5) years.
- E. The Contractor shall maintain service facilities in the installation area. The facilities shall include a permanent source of factory trained service technicians on twenty-four (24) hour call experienced in servicing this type of cabling system and shall provide warranty and routine maintenance service to afford the Owner maximum coverage. The Contractor shall also provide a central source of support to guarantee immediate answers to Owner's problems and questions.
- F. The Contractor selected for this project must be certified by the manufacture(s) specified within their submittals, adhere to the engineering, installation, and testing procedures, and utilize the recommended components in provisioning the voice and data aspects of this Project.
- G. Any sub-contractor who will assist the Contractor in performance of this work shall have the same training and certification as the Contractor.
- H. The Contractor shall procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein. The Contractor shall conform in all trades with all local regulations and codes.
- I. The Contractor shall guarantee at the time of the bid that all cabling and components meet or exceed specifications of ANSI/TIA-568.2-D.
- J. The Contractor shall provide as part of the bid proposal a complete bill of materials, including catalog cuts, line item and extended pricing, and equipment configurations for all technologies noted in this section. This is in addition to the requests on the bid form.

- K. The components shall be new, of modern design, and current standard production of the various manufacturers.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.
- B. The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor's expense.
1. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.
  2. Do not install damaged equipment. Remove damaged equipment from the site and replace with new equipment.
  3. If off-site storage of materials is necessary, this shall be at the Contractor's expense.

#### **1.06 SUBMITTALS**

- A. Shop Drawings: Within ten (10) calendar days after award of contract, the Contractor shall submit product data cut sheets and catalog information to the Technology Designer for approval. The Contractor shall not begin installation or fabrication without such approval. The Technology Designer will indicate approval of shop drawings, product data, and samples submitted to the Designer by stamping such submittals "APPROVED" with a stamp. All shop drawings shall be marked with the pertaining specification paragraph or drawing number when submitted. Submit electronically of each item to the Technology Designer.
- B. Shop drawings shall be submitted on the following:
1. Bill of materials and cut sheets.
  2. Project schedule including all major work components that materially affect any other work on the project.
  3. Anticipated lead times on all major components
- C. A technical data sheet from the manufacturer shall be included with the response for each product proposed.
- D. Submittals shall include all manufacturers cut sheets for the following:
1. Data cabinet
  2. Cable support system J-hooks in closets
  3. Grounding and bonding components

#### **1.07 RELATED WORK BY OTHERS**

- A. Power outlets and electrical wiring
- B. Conduits and outlet boxes, as indicated on the drawings
- C. Conduit sleeves, as indicated on the drawings
- D. Raceways, as indicated on the drawings
- E. Uninterruptible Power Supplies (UPS's)

#### **1.08 WARRANTY**

- A. All SCS components and installation of same shall be guaranteed free of defects in materials and workmanship for one (1) year and shall be repaired or replaced within twenty-four (24) hours following report of such component defects and installation workmanship by the Owner.
- B. The Contractor shall be available on call and shall respond on site within one (1) business day of notice, and without cost to the Owner, during the first twelve (12) months of full-scale operation, following acceptance of the system, to repair and/or correct any problems that may arise during the initial period of operation.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. The proposed major components shall have a consistent architecture to reduce total cost of ownership for on-going support, maintenance, and training.
- B. The Contractor shall provide all equipment, miscellaneous cables, terminators, materials, parts, software, and labor for a complete and satisfactory operating environment.
- C. Systems shall be in full accordance with the recommendations of the equipment and software manufacturers, with the requirements of the specifications, and with all current edition or revision of all applicable codes and standards as listed under references in this section of the specifications.

### **2.02 MANUFACTURERS**

- A. Approved cabinet manufacturers:
  - 1. Middle Atlantic
  - 2. Tripp-Lite
  - 3. Hubbell
  - 4. Approved equivalent

### **2.03 WALL MOUNTED CABINETS**

- A. Installation location:
  - 1. Field Building Mechanical / Electrical Room
- B. EIA compliant 19" vertical low profile wall cabinet
- C. 6 Rack Unit (RU)
- D. Black, powder coat finish
- E. (1) Exhaust Kit with (2) Fans (SRFANWM)
- F. (1) UPS Mounting Kit (UPSHDEARKIT)
- G. Approved Product:
  - 1. Tripp-Lite SRWF6U36
  - 2. Approved equivalent

### **2.04 UNSPECIFIED EQUIPMENT AND MATERIAL**

- A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. All work materials shall be removed at the end of the workday and the work area left in the same or better condition as found.
- B. This Contractor shall have a minimum of five (5) years of experience in the specific application of the equipment proposed of these systems.
- C. Adherence to a schedule of working hours which is agreeable with the Owner will be required.
- D. The Contractor shall provide any necessary screws, anchors, clamps, Velcro-style tie wraps, "J" hooks, miscellaneous grounding, and support hardware, etc., necessary to facilitate the installation of the system.

- E. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the system.

### **3.02 EQUIPMENT CABINETS**

- A. General location and placement of equipment cabinets and racks is shown on the Project Drawings.
- B. Verify exact placement of cabinets and racks with the Owner prior to final installation and mounting.
- C. Equipment cabinets and racks shall be assembled and installed per the manufacturer's printed instruction.
- D. Floor mounted cabinets must be attached to the floor using mounting anchors recommended by the manufacturer's installation instructions as appropriate for floor type.
- E. Wall mounted cabinets must be attached to the wall using mounting anchors recommended by the manufacturer's installation instructions as appropriate for wall type.
- F. Do not install patch panels, cabling or equipment to the cabinets and racks until their installation has been accepted by the Owner.
- G. Cabinets and racks are to be installed such that there are no obstructions or impediments to the full opening radius of the enclosure.
- H. Cabinets and racks are to be mounted such that they do not obstruct access to any other junctions, pull boxes, control panels , cabinets, etc.
- I. Secure all equipment to the cabinets and racks with mounting hardware specified by or provided by the manufacturer.

### **3.03 LABELING**

- A. All cable designations and color-coding shall be in full compliance with TIA/EIA 606.
  - 1. The Contractor shall label each cabinet and rack with a white permanent polyester label with black lettering noting the rack designation as provided by the Owner.
  - 2. The specific labeling scheme for each facility will be determined by the Owner at the time of installation.

### **3.04 GROUNDING AND BONDING**

- A. Equipment cabinet and ladder rack bonding and grounding shall be in accordance with the NEC® and NFPA. Cabinets and ladder racking shall be grounded and bonded in compliance with ANSI/TIA-607-D, ANSI/NFPA 70, and local requirements and practices.
- B. When required by local code, provide a Telecommunications Bonding Backbone utilizing a No. 6 AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

**END OF SECTION**

---

**SECTION 27 1323**  
**COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. The Contractor shall provide the services necessary to engineer, furnish, install, test, and certify a warranted and fully operational system conforming to manufacturer specifications and acceptable industry standards.
- B. This section includes the minimum requirements for the installation of optical fiber backbone cabling between telecommunications rooms.
- C. This section includes, but is not limited to the following:
  - 1. Optical fiber cabling
  - 2. Optical fiber enclosures and terminations
  - 3. Optical fiber patch cords
- D. Provide all labor, materials, and equipment for the completion of work called for in the Contract Documents.
- E. The Contractor shall be responsible for providing the services necessary to furnish, configure, deliver, install, integrate, and test all specified equipment. All work shall be in accordance with the intent of these specifications, and as required to leave the infrastructure components complete and in manufacturer certified operating conditions, excluding those items listed under "Work by Others."
- F. The Contractor shall provide any additional items, not specifically mentioned herein or on the drawings, necessary to meet system requirements as specified, without claim for additional payment.
- G. Errors or Omissions in Drawings or Documentation
  - 1. If any errors or omissions appear in Drawings, Specifications, or other documents, the bidding Contractor shall notify the Engineer no later than ten (10) days prior to submitting the bid.
  - 2. Should conflict occur in or between Drawings and Specifications, the bidding Contractor is deemed to have estimated the more expensive way of doing the work, unless the bidding Contractor has asked for and obtained written decision (addendum) before submission of the bid as to which method or materials will be required.
- H. Related Sections:
  - 1. Section 27 11 16 Communications Cabinets, Racks, Frames, and Enclosures
  - 2. Section 27 15 13 Communications Copper Horizontal Cabling

**1.03 DEFINITIONS**

- A. ANSI – American Northern Standards Institute
- B. BICSI – Building Industry Consulting Service International
- C. EIA – Electronics Industry Alliance
- D. IEEE – Institute of Electrical and Electronic Engineers
- E. ISO – International Standards Organization
- F. NFPA – National Fire Protection Agency
- G. TIA – Telecommunications Industry Association



- H. SM – Single Mode Fiber
- I. UL – Underwriters Laboratory
- J. UTP - Unshielded Twisted Pair
- K. FO - Fiber Optic
- L. Structured Cabling System (SCS): A SCS is defined as all required cabling including hardware, termination blocks, cross connect wire or cordage, patch panels, patch cords, telecommunication outlets, work area cords, UTP and fiber optic cable installed and configured to provide computer data and voice connectivity from each data or voice device to the network file server or voice network/switch designated as the service point of the local area network.
- M. Main Distribution Frame (MDF): This technology space houses main network distribution equipment and acts as the main connection point between the Core/Network and the TR/IDF/access zones for all connections.
- N. Intermediate Distribution Frame (IDF): is the location for the termination of backbone cables and for termination of horizontal cables, and for the interconnection of each. The space also hosts access–layer switches and user network connections within each floor.
- O. Backbone: cabling system consisting of media and termination hardware interconnecting MDFs to IDFs.
- P. Horizontal: cabling system consisting of media and termination hardware interconnecting the Telecommunication Outlets (TOs) and the TRs.
- Q. Cabinet: free standing, floor–mounted or wall–mounted modular enclosure designed to house and protect rack–mounted electronic equipment and passive terminations; usually referred to as an equipment cabinet.
- R. Rack: An open, freestanding, floor–mounted structure, typically made of aluminum or steel, used to mount equipment; usually referred to as an equipment rack.
- S. Ladder Rack: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- T. Patch Panel: system of terminal blocks or connectors used with patch cords that facilitate administration of cross–connect fields.
- U. Bonding: permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed on it.
- V. Grounding: a conducting connection to earth, or to some conducting body that serves in place of earth.
- W. Patch Cords: a length of wire or fiber cable with connectors on one or both ends used to join communications circuits at a cross–connect.
- X. Pathway: facility for the placement of communications cable. A pathway facility can be composed of several components including conduit, wireway, cable tray, surface raceway, under floor systems, overhead systems, raised floor, ceiling support wires, etc.

#### **1.04 QUALITY ASSURANCE**

- A. The system will adhere to the most current applicable rulings of the Federal Communications Commission (FCC). Provide the FCC registration number with the equipment submittal. All components and installations shall bear an Underwriters' Laboratories (UL) listing and shall conform with the latest edition or revision of the following codes and standards:
  - 1. ANSI American National Standards Institute
  - 2. ASTM American Society for Testing and Materials
  - 3. BICSI Building Industry Consulting Service International
  - 4. CSI Construction Specifications Institute
  - 5. EIA Electronics Industries Alliance

- 
6. FCC Federal Communications Commission
  7. ICEA Insulated Cable Engineers Association
  8. IEC International Electro Technical Commission
  9. IEEE Institute of Electrical and Electronics Engineers
  10. ISO International Organization for Standardization
  11. NEC National Electrical Code
  12. NEMA National Electrical Manufacturer's Association
  13. NFPA National Fire Protection Association.
  14. TIA Telecommunications Industry Association
  15. UL Underwriters Laboratories, Inc.
- B. The code or standard establishing the more stringent requirements shall be followed where areas of conflict occur between codes and standards or between codes and standards and drawings and specifications.
- C. References:
1. BICSI Telecommunications Distribution Methods Manual
  2. BICSI Cabling Installation Manual
  3. BICSI LAN Design Manual
  4. CSI Master Format 2016 Edition – Division 27 - Communications
  5. ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard
  6. ANSI/TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standard
  7. ANSI/TIA-568.3-D – Optical Fiber Cabling and Components Standard
  8. ANSI/TIA-569-E – Telecommunications Pathways and Spaces
  9. ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure
  10. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
  11. ISO/IEC 11801 – Information Technology – General Cabling for Customer Premises
  12. ISO/IEC 11801 – Information Technology – Pathways and Spaces for Customer Premises Cabling
  13. NFPA 70, NEC and NFPA 255
  14. UL Cable Verifications Program
  15. UL Testing Bulletin
- D. All materials shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar systems for a minimum of five (5) years.
- E. The Contractor shall maintain service facilities in the installation area. The facilities shall include a permanent source of factory trained service technicians on twenty-four (24) hour call experienced in servicing this type of cabling system and shall provide warranty and routine maintenance service to afford the Owner maximum coverage. The Contractor shall also provide a central source of support to guarantee immediate answers to Owner's problems and questions.
- F. The Contractor selected for this project must be certified by the manufacture(s) specified within their submittals, adhere to the engineering, installation, and testing procedures, and utilize the recommended components.
- G. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical fiber distribution systems and have personnel who are trained and certified in the use of such tools and equipment.
- H. Any sub-contractor who will assist the Contractor in performance of this work shall have the same training and certification as the Contractor.

- 
- I. The Contractor shall procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein. The Contractor shall conform in all trades with all local regulations and codes.

#### **1.05 SUBMITTALS**

- A. Shop Drawings: Within ten (10) calendar days after award of contract, the Contractor shall submit product data cut sheets and catalog information to the Technology Designer for approval. The Contractor shall not begin installation or fabrication without such approval. The Technology Designer will indicate approval of shop drawings, product data, and samples submitted to the Designer by stamping such submittals "APPROVED" with a stamp. All shop drawings shall be marked with the pertaining specification paragraph or drawing number when submitted. Submit electronically of each item to the Technology Designer.
- B. Shop drawings shall be submitted on the following:
  1. Bill of materials and cut sheets.
  2. Project schedule including all major work components that materially affect any other work on the project.
  3. Anticipated lead times on all major components
- C. Submittals shall include all manufacturers cut sheets for the following:
  1. Optical fiber cable
  2. Optical fiber patch panels
  3. Optical fiber connectors
  4. Cable support systems

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
  1. Test optical fiber cable to determine the continuity of the strand end to end.
  2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
- B. To prevent damage, theft, soiling, and misalignment, protect equipment during transit, storage, and handling.
- C. The contractor shall coordinate the secure storage of equipment and materials on site, or, if no on-site storage is available, shall provide their own secure storage at the Contractor's expense.
  1. Do not store equipment where conditions fall outside the manufacturer's recommendations for environmental conditions.
  2. Do not install damaged equipment. Remove environmental conditions from the site and replace damaged equipment with new equipment.
  3. If off-site storage of materials is necessary, this shall be at the Contractor's expense.

### **PART 2 - PRODUCTS**

#### **2.01 GENERAL**

- A. The proposed major components shall have a consistent architecture to reduce total cost of ownership for on-going support, maintenance, and training.
- B. The Contractor shall provide all equipment, miscellaneous cables, terminators, materials, parts, software, and labor for a complete and satisfactory operating environment.
- C. Systems shall be in full accordance with the recommendations of the equipment and software manufacturers, with the requirements of the specifications, and with all current edition or

---

revision of all applicable codes and standards as listed under references in this section of the specifications.

## **2.02 MANUFACTURERS**

- A. Systems shall be in full accordance with the recommendations of the equipment and software manufacturers, with the requirements of the specifications, and with all current edition or revision of all applicable codes and standards as listed under references in this section of the specifications.
- B. Approved optical fiber cabling and component manufacturers:
  - 1. Corning
  - 2. Pre-approved equivalent

## **2.03 OPTICAL FIBER CABLE**

- A. Single-mode (OS2)
- B. Tight-buffered, indoor/outdoor plenum armored interlocking optical fiber
- C. Twelve (12) strand fiber count
- D. NEC Type OFCP (NFPA 262) compliant for plenum
- E. OSP (outdoor) water blocking
- F. Outer jacket color: Black
- G. Approved product:
  - 1. Corning FREEDM One 012E8P-31131-A3
  - 2. Pre-approved equivalent

## **2.04 OPTICAL FIBER CONNECTORS**

- A. Single-mode (OS-2)
- B. LC type
- C. No epoxy, no polish field installable
- D. Ceramic ferrule
- E. Composite housing
- F. Blue housing color
- G. Blue boot color
- H. 0.5 dB maximum insertion loss
- I. UPC polish
- J. Approved product:
  - 1. Corning 95-200-99
  - 2. Pre-approved equivalent

## **2.05 OPTICAL FIBER ENCLOSURES**

- A. 19" rack mountable
- B. 1RU for two adapter panels
- C. Powder coated metal and polycarbonate slide out tray
- D. Removable tinted polycarbonate front door
- E. Internal and external strain relief
- F. Lockable

- G. Approved product:
  - 1. Corning CCH series CCH-01U
  - 2. Pre-approved equivalent

## **2.06 OPTICAL FIBER ADAPTER PANELS**

- A. Single-mode (OS-2)
- B. Blue composite housing
- C. LC duplex adapters
- D. 12 fiber count
- E. Ceramic insert
- F. UPC polish
- G. Approved product:
  - 1. Corning CCH-CP12-A9
  - 2. Pre-approved equivalent

## **2.07 OPTICAL FIBER PATCH CORDS**

- A. Optical fiber patch cords shall be provided by the Contractor and installed by the Owner.
- B. Single-mode (OS-2)
- C. 2 fiber count
- D. LC duplex to LC duplex
- E. UPC polish
- F. Non-keyed
- G. Ceramic ferrule
- H. Composite housing
- I. Yellow jacket color
- J. Blue boot cover
- K. Blue housing color
- L. 3 meters long
- M. Quantity:
  - 1. Four (4)
- N. Approved product:
  - 1. Corning 040402G5120003M
  - 2. Pre-approved equivalent

## **PART 3 – EXECUTION**

### **3.01 GENERAL**

- A. Upon completion of work, the Contractor shall submit as-built drawings to the Owner and Engineer.
- B. Install all cables in accordance with project drawings.
- C. Provide any screws, anchors, clamps, tie wraps, distribution rings, miscellaneous grounding, and support hardware, etc. needed to facilitate the installation of the cable plant system.
- D. Furnish any special installation equipment or tools required to properly complete the installation.
- E. Do not roll or store cable reels without an appropriate underlay.

- F. Failure to follow the appropriate guidelines may require the installer to provide the additional material and labor required to bring the installation back into alignment with the guidelines. This shall also apply to any and all damages caused to the cables by the installer during the implementation.
- G. Provide fire stopping at all fire-rated ceiling, wall, and floor penetrations.
- H. Plug conduits where cabling has been installed in the main equipment room, backbone, and other cable entrance locations with re-enterable duct seal of flame-retardant putty.
- I. All wiring, materials, and equipment must be listed and labeled by an NRTL. To certify that performance characteristics, meet ANSI/TIA 568 Standards, provide all Original Equipment Manufacturer (OEM) documentation to the Owner.
- J. Any pathways shown on the drawings are suggested routes for the Contractor to use as guidelines. Prior to construction, the Contractor shall coordinate in the field with other trades to determine the exact feeder, tie, and riser backbone cabling pathways. In any case where the communication pathway must be removed and re-routed, due to conflicts with other trades with which the Contractor did not previously coordinate, the Contractor is responsible for all costs associated with the removal and relocation.

### **3.02 OPTICAL FIBER BACKBONE CABLE**

- A. Install the optical fiber backbone in a continuous length "homerun" from the OFE in the MDF to an OFE within each IDF.
- B. Upon entering the MDF/IDF the backbone fiber optic cable shall be routed on ladder rack to the designated rack location.
- C. Leave a 10-foot maintenance loop at each end of the link, neatly contained in the cabinet or ladder rack in a "figure 8" loop at the rear of the OFE.
- D. Throughout the length of the cable, maintain the minimum bend radius and pulling force recommended by the manufacturer and required by industry standards, both during installation and after termination and testing.
- E. Cable slack in each MDF/IDF shall be contained and routed in the cable tray. Do not coil the cable to achieve the service loop.
- F. Provide a 3-foot maintenance loop of stripped fiber strands at each end of the link, neatly wrapped at each fiber optic patch panel.
- G. On each end, remove all outer jacket and strength member materials to expose the individual 900-micron buffering of the individual strands for a length of 0.5 m (18 inches).
- H. On each end, hold the cable ends securely in place with the cable clamping accessories in each OFE.
- I. Route individual strands in the rear of the OFE in a neat and orderly fashion and place them so as not to create undue stress or micro bending of the strands.
- J. Secure all cable bundles with proper bundling or securing materials to ensure that the cable runs are securely held in place both vertically and horizontally.
- K. Do not tighten bundling materials or securing devices so tightly that they deform the inherent cable geometry or construction.
- L. Do not use cable ties or hook-and-loop tape to secure cable runs to other building systems such as electrical conduit, Electric Metallic Tube (EMT), sprinkler pipes, ceiling suspension members.
- M. In environmental air-handling spaces, only use appropriately listed materials.
- N. Follow all manufacturer's written instructions for installation.

### **3.03 LABELING**

- A. Uniquely identify all components of the installed system by location, function, unit, and sub-unit.

- B. Identify each location with a unique alphanumeric identifier.
- C. Assign a unique alphanumeric identifier for each equipment enclosure in the building.
- D. Identify each adapter module in each distribution or interconnect enclosure with an alphanumeric identifier.
- E. Identify all conduits, trays, and pathways with a unique alphanumeric identifier.
- F. Identify optical fiber cables by a textual label that indicates its type, strand count, point of origin, and termination.
- G. Supply a Cable Identification Matrix
- H. Supply all records in compliance with ANSI/TIA-606-D.
- I. Before installing or terminating cable, confirm all specific labeling requirements with the Owner or the Owner's Engineer.
- J. Mark each backbone cable at each endpoint and at all intermediate pull and access points and junction boxes with a label that indicates the origination and destination identifiers, the sheath identifier, and the strand or pair range.
- K. Optical Fiber Enclosures (OFEs)
  - 1. Mark each OFE with an adhesive label that indicates the range of circuits installed within it.
  - 2. Label each port with the origination and destination grid identifier and the individual strand ID.
  - 3. At each end of each cable, within 75 mm (3 inches) of the end of the sheath, place a self-laminating label that surrounds the outermost jacket and bears the appropriate cable identifier.
  - 4. On each equipment enclosure, affix self-adhesive labels, bearing the enclosure's identifier in block characters, at the top center of the front and rear doors or faces.
  - 5. In all enclosures, place a label directly adjacent to the shortest side of each adapter that bears that adapter's identifier. Rotate the characters on the labels to maintain a left to right, top to bottom orientation.

### **3.04 GROUNDING AND BONDING**

- A. Communication bonding and grounding shall be in accordance with the NEC® and NFPA. Armored optical fiber cables and OFEs shall be grounded in compliance with ANSI/TIA-607-D, ANSI/NFPA 70, and local requirements and practices.
- B. When required by local code, provide a Telecommunications Bonding Backbone utilizing a No. 6 AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

### **3.05 OPTICAL FIBER CABLE TESTING**

- A. The Contractor shall test all fiber optic cables installed under these specifications.
- B. Testing shall be performed on a fully completed system after all hardware is installed and attached and all labeling and identification has been completed.
- C. Fiber shall be tested utilizing the one-jumper reference method.
- D. Perform end-to-end, bi-directional attenuation test for each fiber at 1310nm and 1550nm wavelengths.
- E. The attenuation shall not exceed the maximum fiber loss allowable per TIA-568.3-D.
- F. The Contractor shall supply test results which include the following:
  - 1. Date of test

2. Test personnel
  3. Field instrument used (Manufacturer model number and serial number)
  4. Test equipment calibration date
  5. Type and length of reference jumpers
  6. Fiber ID
  7. Test procedure and reference method used
  8. Link-loss results
- G. Cable test results shall be stored and presented to the Owner in both hard copy and electronic format for approval.
- H. Any cable or component that does not meet the required operational tests or fails to meet installation standards as specified shall be repaired or replaced by the Contractor as directed by, and at no expense to, the Owner.

### **3.06 WORK BY OTHERS**

- A. Power outlets and electrical wiring
- B. Conduits and outlet boxes
- C. Conduit sleeves, as indicated on the drawings
- D. Raceways, as indicated on the drawings
- E. Network Switches
- F. Wireless Access Points (WAPs)
- G. Security Cameras
- H. SMART Interactive Flat Panels
- I. Uninterruptible Power Supplies (UPS's)

### **3.07 WARRANTY**

- A. All components and installation of same shall be guaranteed free of defects in materials for five (5) years and workmanship for one (1) year.
- B. All components shall be repaired or replaced within twenty-four (24) hours following report of such component defects and installation workmanship by the Owner.
- C. The Contractor shall be available on call and shall respond on site within four (4) hours of notice, and without cost to the Owner, during the first twelve (12) months of full-scale operation, following acceptance of the system, to repair and/or correct any problems that may arise during the initial period of operation.
- D. If the Contractor shall fail to provide its best efforts to perform warranty obligations in a timely manner, the Owner, at its sole discretion, will secure the necessary services from other suppliers selected by the Owner, and the Contractor shall reimburse the Owner for the cost of such services.

### **3.08 DRAWINGS AND DOCUMENTATION**

- A. Fully detailed documentation and record drawings of installation layout and performance shall be submitted for review within thirty (30) days of completion of work and shall include as a minimum:
  1. Marked drawings showing routing of all inside cable with gauge, type, and numbering scheme.
  2. Location of outlets with their new identification number prepared on most recent installation drawing.



3. Drawings shall accurately record actual locations of each item of fixed equipment and show interconnecting wiring. Drawings will indicate location of equipment and tagged circuits. A functional block diagram will also be required.
- B. Drawings, whenever submitted, shall be submitted with two (2) copies to the Owner.
- C. Final record drawings shall be submitted as two (2) sets of scaled drawings and an electronic copy in AutoCAD 2018 or higher format. Drawings shall be professionally done. Hand drawings and notations will not be accepted.
- D. Submit pictures of the equipment rooms, backboards, and rack elevations. Pictures must include room entry point, all surrounding walls, backboards, front rack elevations and rear rack elevations.
- E. All drawings and the information contained therein become the sole property of the Owner.

### **3.09 CLOSEOUT**

- A. Punch List
  1. The Contractor shall perform required remedial work, without claim for additional labor or other costs. Where required, the Contractor shall re-test and submit a revised Test Report.
  2. The Contractor shall notify the Technology Designer of completion of the Punch List.
  3. If after notification and inspection by the Technology Designer, the identified Punch List items have not been corrected the Contractor will be notified that remedial work is still required. Additional time spent by the Technology Designer, due to the failure of the Contractor to correct Punch List items and finish the project by the agreed upon completion date as set forth in the Contract Documents, will be charged to the Contractor at the rate of one hundred twenty-five dollars (\$125) per hour and deducted from the Contractors retainage.
  4. Fully detailed documentation, record drawings of the installation, cabinet layouts, and performance shall be submitted for review.
  5. Final payment/retainage will NOT be considered if all aspects of work have not been satisfied and approved by the Technology Designer.

### **3.10 THE OWNER'S RIGHT TO USE**

- A. Acceptance of the Work of this Section will occur after completion of corrections and adjustments required by "Punch List" (as generated during on-site inspections and review of testing documentation).
- B. The Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

**END OF SECTION**

---

**SECTION 27 1513  
COMMUNICATIONS COPPER HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract Documents apply to work of this Section.

**1.02 SUMMARY**

- A. The Contractor shall provide the services necessary to engineer, furnish, install, test, and certify a warranted and fully operational system conforming to manufacturer specifications and acceptable industry standards.
- B. All work shall be in accordance with the true intent of these drawings and specifications, and as required to leave the system complete and in satisfactory operating condition, excluding those items listed under "Related Work Provided by Others."
- C. The Contractor shall provide a complete Bill of Materials, catalog cuts, unit and extended cost for labor and materials.
- D. The Contractor shall verify dimensions and conditions at the job site prior to bidding, installation, and perform installation in accordance with these Specifications, manufacturers' recommendations and the latest edition or revision of all applicable codes and standards.
- E. Equipment, materials, labor, and services to provide Structured Cabling System including, but not limited to:
1. Copper horizontal cabling, outlets, and terminations
  2. Cabling support system in ceilings terminations
  3. Copper patch cords
  4. Bonding and Grounding
  5. Labeling of patch panels, Category 6 cabling, and faceplates
  6. Category 6 certification testing
  7. Provide as-built drawings
  8. Other Requirements:
    - a. Sleeve, cores, raceway, power poles, back boxes, and conduit not provided by other Trades.
    - b. Firestop all floor or wall penetrations
    - c. Provide a 20-year manufacturer's warranty
- F. Provide all equipment, materials, labor, and services, not specifically mentioned or shown, which may be necessary to complete or perfect all parts of the installation. Ensure that they follow requirements stated or reasonably inferred by the contract documents.

**1.03 QUALITY ASSURANCE**

- A. The system will adhere to the most current applicable rulings of the Federal Communications Commission (FCC). Provide the FCC registration number with the equipment submittal. All components and installations shall bear an Underwriters' Laboratories (UL) listing and shall conform with the latest edition or revision of the following codes and standards:
1. ANSI American National Standards Institute
  2. ASTM American Society for Testing and Materials
  3. BICSI Building Industry Consulting Service International
  4. CSI Construction Specifications Institute
  5. EIA Electronics Industries Alliance
  6. FCC Federal Communications Commission
  7. ICEA Insulated Cable Engineers Association
  8. IEC International Electro Technical Commission
  9. IEEE Institute of Electrical and Electronics Engineers

10. ISO International Organization for Standardization
  11. NEC National Electrical Code
  12. NEMA National Electrical Manufacturer's Association
  13. NFPA National Fire Protection Association.
  14. TIA Telecommunications Industry Association
  15. UL Underwriters Laboratories, Inc.
- B. The code or standard establishing the more stringent requirements shall be followed where areas of conflict occur between codes and standards or between codes and standards and drawings and specifications.
- C. References:
1. BICSI Telecommunications Distribution Methods Manual, 14<sup>th</sup> Edition
  2. BICSI Cabling Installation Manual
  3. CSI Master Format 2016 Edition – Division 27 - Communications
  4. ANSI/TIA-568.1-E – Commercial Building Telecommunications Infrastructure Standard
  5. ANSI/TIA-568.2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standard
  6. ANSI/TIA-568.3-D – Optical Fiber Cabling and Components Standard
  7. ANSI/TIA-569-E – Telecommunications Pathways and Spaces
  8. ANSI/TIA-606-D – Administration Standard for Telecommunications Infrastructure
  9. ANSI/TIA-607-D – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
  10. ISO/IEC 11801 – Information Technology – General Cabling for Customer Premises
  11. ISO/IEC 11801 – Information Technology – Pathways and Spaces for Customer Premises Cabling
  12. NFPA 70, NEC and NFPA 255
  13. UL Cable Verifications Program
  14. UL Testing Bulletin
- D. The SCS shall be manufactured and tested by manufacturers who are regularly engaged in the production of the components of similar SCS systems for a minimum of five (5) years.
- E. The supplier of the SCS shall maintain service facilities in the installation. The facilities shall include a permanent source of factory trained service technicians experienced in servicing this type of cabling system and shall provide warranty and routine maintenance service to afford the Owner maximum coverage. The Contractor shall also provide a central source of support to guarantee immediate answers to Owner's problems and questions.
- F. The Contractor selected for this project must be certified by the manufacture(s) specified within their submittals, adhere to the engineering, installation and testing procedures and utilize the recommended components in provisioning the voice and data aspects of this Project.
- G. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of Category 6 distribution systems and have personnel who are trained and certified in the use of such tools and equipment.
- H. A resume of qualification shall be submitted with the Contractor's proposal indicating the following:
1. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
  2. A list of test equipment proposed for use in verifying the installed integrity of Category 6.
  3. A technical resume of experience for the Contractor's Project Manager and on-site installation supervisor who will be assigned to this project.

4. A list of technical product training attended by the Contractor's personnel that will install the SCS system shall be submitted with the response.
- I. Any sub-contractor who will assist the Contractor in performance of this work shall have the same training and certification as the Contractor.
- J. The Contractor shall procure and pay for all necessary permits, licenses and inspections and observe any requirements stipulated therein. The Contractor shall conform in all trades with all local regulations and codes.
- K. The Contractor shall guarantee at the time of the bid that all cabling and components meet or exceed specifications of ANSI/TIA-568-1.E, ANSI/TIA-568.2-D, and ANSI/TIA-568.3-D.
- L. All materials shall be new and shall conform to applicable provisions of UL and the American Standards Association.
- M. The Structured Cabling components shall be new, of modern design, and current standard production of the various manufacturers.
- N. The Contractor shall be present at weekly or bi-weekly on-site or virtual meetings, as required, throughout the duration of the project with the construction manager and other trades while onsite.

#### **1.04 SUBMITTALS**

- A. Shop Drawings: Within ten (10) calendar days after award of contract, the Contractor shall submit product data cut sheets and catalog information to the Technology Designer for approval. The Contractor shall not begin installation or fabrication without such approval. The Technology Designer will indicate approval of shop drawings, product data, and samples submitted to the Designer by stamping such submittals "APPROVED" with a stamp. All shop drawings shall be marked with the pertaining specification paragraph or drawing number when submitted. Submit electronically of each item to the Technology Designer.
- B. Shop drawings shall be submitted on the following:
  1. Bill of materials and cut sheets.
  2. Project schedule including all major work components that materially affect any other work on the project.
  3. Anticipated lead times on all major components
- C. A technical data sheet from the manufacturer shall be included with the response for each product proposed. This data sheet shall include the physical specifications as well as the following electrical and transmission characteristics if appropriate:
  1. Mutual Capacitance
  2. Impedance
  3. DC Resistance
  4. Attenuation
  5. Worst Pair-to-Pair Near End Cross Talk
  6. Power Sum Near End Cross Talk
- D. Submittals shall include all manufacturers cut sheets for the following:
  1. Category 6 cable and patch cords
  2. Category 6 outlets, jacks, faceplates, and inserts
  3. Copper patch panels
  4. Optical fiber cable, connectors, and termination panels
  5. Data cabinet
  6. Cable support system J-hooks and ladder rack in closets
  7. Grounding and surge suppression system components

### **1.05 EXISTING CONDITIONS**

- A. The Contractor shall visit the sites prior to submitting a bid. No subsequent allowance will be made due to failure to thus observe and verify conditions, which may affect the work. The Contractor shall report to the Technology Designer any discrepancies between these specifications and existing conditions and similarly report obvious omissions.

### **1.06 JOB CONDITIONS**

- A. The Contractor shall keep the job adequately staffed at all times. Unless illness, loss of personnel or other circumstances beyond the control of the Contractor, the Contractor shall maintain the same individual in charge throughout the Project.
- B. The Contractor shall cooperate with all appropriate parties to achieve well-coordinated progress with the overall construction completion schedule and satisfactory final results.
- C. The Contractor shall watch for conflicts with work of other contractors on the job and execute, without claim for extra payment, moderate moves or changes as are necessary to accommodate other equipment or to preserve symmetry and aesthetically pleasing appearance.
- D. The Contractor shall immediately report to the Technology Designer any design or installation irregularities, particularly architectural elements that interfere with the intended systems operation, so that appropriate action may be taken.
- E. The Contractor shall do all cutting, patching and painting necessary for proper and finished installation of the system and repair any damage done as a result of such installation.
- F. The Contractor shall cleanup and dispose of trash from all SCS work areas daily.

### **1.07 RELATED WORK BY OTHERS**

- A. Power outlets and electrical wiring
- B. Conduits and outlet boxes
- C. Conduit sleeves, as indicated on the drawings
- D. Raceways, as indicated on the drawings
- E. Network Switches
- F. Wireless Access Points (WAPs)
- G. Uninterruptible Power Supplies (UPS's)
- H. Security Cameras
- I. Audio Video Equipment

### **1.08 WARRANTY**

- A. All SCS components and installation of same shall be guaranteed free of defects in materials and workmanship and shall be repaired or replaced within twenty-four (24) hours following report of such component defects and installation workmanship by the Owner.
- B. The Contractor shall be available on call and shall respond on site within one (1) business day of notice, and without cost to the Owner, during the first twelve (12) months of full-scale operation, following acceptance of the system, to repair and/or correct any problems that may arise during the initial period of operation.
- C. The components of this project, upon completion will be warranted by the manufacturer. The warranty for this wiring system shall be provided as follows:
  - 1. The twenty (20) Year Warranty shall ensure against product defects, that all approved cabling components meet or exceed the specifications and performance requirements of ANSI/TIA-568.1-E, ANSI/TIA-568.2-D, and ANSI/TIA-568.3-D, ANSI/TIA -569-E, ANSI/TIA-606-D, ANSI/TIA-607-D and ISO/IEC 11801 for the copper and fiber optic

cabling links/channels. The end-to-end passive product solution shall be capable of delivering Category 6 performance to the networked devices. The warranty shall apply to all passive SCS components.

2. The twenty (20) Year Product Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s) for a twenty (20) year period.
3. A twenty (20) Year Application Assurance shall cover the failure of the cabling system to support the application which it was designed to support, as well as additional application(s) introduced in the future within the recognized standards or user forums that use the ANSI/TIA-568.1-E, ANSI/TIA-568.2-D, and ANSI/TIA-568.3-D and ISO/IEC IS 11801 component and link/channel specifications for cabling.
4. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a certificate, from the manufacturer, registering the installation.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- A. The proposed major components shall have a consistent architecture to reduce total cost of ownership for on-going support, maintenance, and training.
- B. The Contractor shall provide all equipment, miscellaneous cables, terminators, materials, parts, software, and labor for a complete and satisfactory operating environment.
- C. SYSTEMS SHALL BE IN FULL ACCORDANCE WITH THE RECOMMENDATIONS OF THE EQUIPMENT AND SOFTWARE MANUFACTURERS, WITH THE REQUIREMENTS OF THE SPECIFICATIONS, AND WITH ALL CURRENT EDITION OR REVISIONS OF ALL APPLICABLE CODES AND STANDARDS AS PREVIOUSLY LISTED UNDER "REGULATORY AGENCIES" OF THIS SECTION OF THE SPECIFICATIONS.

### **2.02 CATEGORY 6 CABLE**

- A. Category 6 rated, 100 ohm balanced Unshielded Twisted Pair (UTP) with four individually twisted-pairs, which exceed the mechanical and transmission performance specifications in ANSI/TIA-568.2-D, 250 MHz.
- B. 23 AWG solid bare annealed copper
- C. NEC/CEC Type CMP (NFPA 262) compliant for plenum spaces
- D. Cable color specification:
  1. Data – Blue
  2. Security Cameras – Purple
  3. Wireless Access Points – Green
- E. Approved Manufacturers:
  1. General Cable GenSPEED 6 Category 6 23 AWG Plenum
  2. Mohawk 6 LAN Category 6 23 AWG Plenum
  3. Superior Essex 77 Series Category 6 23 AWG Plenum
  4. Or pre-approved equivalent

### **2.03 CATEGORY 6 DATA JACKS**

- A. Data jacks shall be 8-position configuration and shall meet all the transmission performance of the specified Category 6 cable.
- B. The jacks shall be wired to TIA/EIA 568B color code wiring scheme.
- C. Keystone type module.
- D. Jack color specifications:
  1. Data – Blue
  2. Security Cameras – Purple

3. Wireless Access Points – Green

- E. Jacks shall mount within keystone faceplates at the workstation locations.
- F. Jacks shall mount within new modular patch panels in Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF) locations.
- G. Approved Manufacturers:
  - 1. Hubbell NEXTSPEED Xcelerator HXJ6\* (\* denotes color)
  - 2. Ortronics TechChoice KS6\* (\*denotes color)
  - 3. Panduit NetKey NK688M\* (\* denotes color)
  - 4. Or pre-approved equivalent

**2.04 PATCH PANELS**

- A. 19 in. rack mountable, 48-port, 2 RU flush mount modular patch panels.
- B. Keystone openings to accept the data jacks specified.
- C. Patch panels shall have area for labels and identifications of each port.
- D. Patch panels shall be black in color.
- E. Patch panels must include rear cable strain relief bar.
- F. Approved Manufacturers:
  - 1. Hubbell HPJ48
  - 2. Ortronics SPKFBU48
  - 3. Panduit NKPP48FMY
  - 4. Or pre-approved equivalent

**2.05 FACEPLATES AND OUTLET BOXES**

- A. The Contractor shall provide faceplates, as indicated on the drawings. Install blanks as required. Conduit and back box shall be provided and installed by others.
- B. Faceplates shall accept keystone modules.
- C. Faceplates shall be satin-finished stainless steel.
- D. Faceplate-securing screws shall match the faceplate finish.
- E. The Contractor shall provide Wiremold inserts at all Wiremold locations, as indicated on the drawings. Install blanks as required. Wiremold 4000 raceway will be supplied and installed by others.
- F. Provide modular inserts, jacks and/or connectors and blanks for all unused outlet ports.
- G. Approved Manufacturers:
  - 1. Hubbell
  - 2. Ortronics
  - 3. Panduit
  - 4. All faceplates and surface boxes shall match existing color scheme of new Wiremold and existing outlets within each facility.

**2.06 COPPER PATCH CORDS**

- A. The Contractor shall provide one (1) Category 6 six-inch (6") 28 AWG patch cord for each drop installed for the MDF/IDF end of the link.
- B. The Contractor shall provide one (1) Category 6 ten foot (10') 23 AWG patch cord for each drop installed for the station/device end of the link.
- C. The copper patch cords shall match the color of the cable for which it is being supplied.
- D. Copper patch cords shall have stranded conductors and be non-booted.

- E. The copper patch cords shall meet or exceed ANSI/TIA 568.2-D standards for Category 6 patch cords.
- F. Approved Manufacturers:
  - 1. Hubbell
  - 2. Ortronics
  - 3. Panduit
  - 4. Match cabling link warranty manufacturer for all patch cords
  - 5. Or pre-approved equivalent

## **2.07 UNSPECIFIED EQUIPMENT AND MATERIAL**

- A. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional SCS installation shall be provided in a level of quality consistent with other specified items.

## **PART 3 - EXECUTION**

### **3.01 GENERAL**

- A. The Contractor shall furnish and install all wiring as indicated in these specifications and on the drawings. All wiring and terminations shall be in full conformance with all of the current editions or revisions of all applicable codes and standards as previously listed under "Regulatory Agencies" of this Section of the Specifications for their intended use on this Project.
- B. No exposed cabling shall be permitted in the wiring of any functions of the provided system. All cable shall be housed in appropriate raceways suitable and designed for such purposes.
- C. All work materials shall be removed at the end of the workday and the work area left in the same or better condition as found.
- D. This Contractor shall have a minimum of five (5) years of experience in the specific application of the equipment proposed of these systems.
- E. Adherence to a schedule of working hours which is agreeable with the Owner will be required.
- F. All cables must be routed and managed for a neat and aesthetically pleasing appearance. All work must be installed in a neat and workmanlike manner.
- G. The Contractor shall work carefully with all ceilings and return ceilings to original conditions. Any damage or expense is the responsibility of the Contractor. Every effort will be made to schedule the requirements under this contract in such a manner so as to complete all above ceiling work prior to ceiling tile installation.
- H. Communication bonding and grounding shall be in accordance with the NEC® and NFPA. Horizontal cables shall be grounded in compliance with ANSI/TIA-607-D, ANSI/NFPA 70, and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment.
- I. The Contractor shall not place any distribution cabling alongside power lines, or share the same conduit, channel, or sleeve with electrical apparatus.
- J. The Contractor shall provide any necessary screws, anchors, clamps, Velcro-style tie wraps, "J" hooks, miscellaneous grounding, ladder rack, cable tray and support hardware, etc., necessary to facilitate the installation of the system.
- K. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the system. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for copper cables, communication devices, jack stands for cable reels, or cable wenchers.
- L. All specialty back boxes shall be provided by the Contractor.



### 3.02 SITE REQUIREMENTS

- A. Horizontal cabling will be terminated at the outlets with Category 6 jacks. At the MDF/IDF locations, the horizontal data cabling will be terminated to modular (48) port patch panels. The patch panels will be mounted into the specified equipment cabinet(s).
- B. Installation practices shall follow BICSI standard and guidelines. TIA/EIA-568.1-E and TIA/EIA-568.2-D standards will be strictly followed and practiced.
- C. All cabling in the MDF or IDFs shall be secured using Velcro-style straps.
- D. All cabinets shall be grounded by the Contractor to the Telecommunications Ground Bar, provided and installed by the electrical contractor, using an approved ground lug and No. 6 AWG jacketed green ground wire.
- E. The Contractor shall provide and install all necessary grounding assemblies for each patch panel. The Contractor shall provide a No. 6 AWG stranded copper wire cable between equipment racks and ground to the Telecommunications Ground Bar.
- F. The Contractor shall be responsible for fire-stopping the exterior of ALL cores and sleeves he/she provides as part of this project. The Contractor shall be responsible for fire-stopping the interior of ALL cores and sleeves provided as part of this project regardless of who provided cores and sleeves. Nelson or 3M moldable fire putty shall be used for floor cores. Nelson or 3M intumescent fire stop caulk with tightly packed mineral wool or ceramic fiber will be used for four-inch (4") conduit sleeves and fire pillows will be used for cable tray access through firewalls as required by local codes.
- G. The Contractor shall provide and install "J" hook cable supports, as required. No D-rings or bridle/saddle rings shall be permitted.
- H. Contractor shall work in close coordination with the construction trades, under the direction of the Construction Manager.
  - 1. Work schedules during the school year shall be second shift and shall not interfere with operation of the buildings.
  - 2. Under no circumstances shall any construction tools, packing materials, loose equipment, ladders, trash, or litter be left in the classrooms at the end of daily shifts. All rooms shall be cleared daily and left in a satisfactory condition. Work activities during summer recess will be based on building schedules. All efforts shall be made during summer recess to have buildings and classrooms open for extended periods. The Construction Manager will outline building schedules to all trades during these periods.
  - 3. Contractor shall be responsible for confirming intended mounting positions of flat panels, wireless access points, and cameras prior to actual installation. This coordination is required for the mounting of other new furnishings and power receptacles for all wall-mounted or ceiling-mounted devices under the scope of this Contractor. This is a critical sequencing requirement; as other Trades will be dependent on precise mounting in order to complete their installation work.

### 3.03 COPPER HORIZONTAL CABLE INSTALLATION

- A. All Category 6 cables shall be continuous from the Main Distribution Frame (MDF) or Intermediate Distribution Frame (IDF) to the media outlet and free from splices, reverses, grounds or other connections. The Contractor shall provide a five foot (5') minimum service loop at the jack end and a ten foot (10') minimum service loop in each closet, wireless access point and camera locations, above accessible ceiling for each terminated cable to accommodate future changes.
- B. The Contractor shall terminate all Category 6 cable according to T568B jack pin assignments.
- C. The Contractor shall remove only the amount of cable jacket necessary for termination. The Contractor shall maintain wire twist for all pairs of Category 6 cable to within one-half (1/2") of the termination point.

- D. The Contractor shall not run cable longer than the maximum ninety (90) meter TIA/EIA recommended length.
- E. Copper splices in the horizontal distribution are prohibited.
- F. All cables installed shall be plenum-rated.
- G. All cables shall be installed using "J" hooks, conduits, cable tray or an approved raceway system. Where cable tray is not available, horizontal cable will be supported every five feet (5') with "J" hooks sufficient in size to handle all bundled cables while minimizing crushing. The Copper cables will be divided into separate bundles and run in separate "J" hooks. If cable slack exceeds twelve (12) inches between supports, additional supports will be installed to take up slack and relieve cable stress.
- H. The Contractor shall carefully lay all cable with appropriate radius of curvature and protect at bends and corners. The Contractor shall observe minimum bend radius and tension limitations as specified by ANSI/TIA for Category 6 cables.
- I. The Contractor shall loosely bundle cables with Velcro-style ties, suitable for Plenum environments, every twenty feet (20').
- J. Cable bundles shall not exceed 192 cables.
- K. Patch panels shall be arranged to allow for natural wiring progression in functional fields, eliminate crossing of wires and allow for the easy access to each component.
- L. The Contractor shall assure that at the completion of cable installation, cables are free from twists, kinks, sharp bends, cuts, gouges or any other physical damage that might cause alterations to the electrical characteristics of the cables.

### 3.04 GROUNDING AND BONDING

- A. Communication bonding and grounding shall be in accordance with the NEC® and NFPA. Horizontal cables shall be grounded in compliance with ANSI-607-D, ANSI/NFPA 70, and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. When required by local code, provide a Telecommunications Bonding Backbone utilizing a No. 6 AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure) and is independent of equipment or cable.

### 3.05 LABELING

- A. The Contractor shall provide cable number designations tags on the cables in each outlet box. All cable designations and color-coding shall be in full compliance with TIA/EIA 606.
- B. The Contractor shall clearly label cables at both ends with permanently applied, mechanically printed labels. Handwritten labels will not be acceptable. The Contractor shall use standardized colors and alphanumeric codes. The Owner shall approve the labeling system and method prior to installation.
- C. Data: In work areas, the Contractor shall place cable ID labels around each new cable drop in the outlet boxes within two (2) inches of the jacks and on front of the faceplates at all locations. Use flexible vinyl or polyester labels that will flex as cables are bent. The Contractor must provide proof of concept labels for Owner approval before any work is performed.
- D. In all MDF and IDF locations, the Contractor shall place ID labels around each cable. Labels shall be located within six (6) inches of the termination. Use flexible vinyl or polyester labels that will flex as cables are bent.
- E. The Contractor shall front label each telecommunications outlet, room, rack, patch panel, and patch panel port and perform continuity, polarity, and map test for each port.

- F. The Contractor shall label all feed/backbone riser cables with destination room number or location.
- G. The specific labeling scheme for each facility will be determined by the Owner at the time of installation.

### **3.06 CATEGORY 6 UTP CABLE TESTING**

- A. The Contractor shall, at all times, permit and facilitate work inspection by the Owner Representative and by public authorities having jurisdiction. The Owner's Representative shall have the authority to stop the work, if required, to insure proper execution.
  - 1. Each UTP cable pair shall be tested end to end from the outlet termination to the patch panel.
  - 2. Tests shall be permanent link only.
- B. Cables and connectors comprising Category 6 must be certified compliant with the performance requirements listed in TIA/EIA-568.2-D.
  - 1. As a minimum, test documentation shall include:
    - a. Cable Identification Number
    - b. Worst Case Near End Cross Talk (NEXT)
    - c. Attenuation
    - d. PSNEXT
    - e. Resistance
    - f. Return Loss
    - g. ELFEXT
    - h. PSELFEXT
    - i. Propagation Delay
    - j. Propagation Delay Skew
    - k. Cable Length
    - l. Test Date
  - 2. Each data circuit, including all connectors, shall be tested to verify all bandwidth performance and crosstalk specifications as outlined for Category 6 cabling. Any cables not in one hundred percent (100%) compliance with the minimum performance criteria relating to Category 6 will be replaced with no additional cost to the Owner.
- C. Cable testing will be conducted by a programmable, ISO/IEC 11801 Class C, D, E, F micro-computer-based tester capable of testing all specific standard requirements and generating completed printed test results.
  - 1. Test equipment shall be a designed, and of such grade, as to provide reliable certification and testing compliant with the SCS manufacturer's requirements.
- D. A detailed hard copy of all test reports shall be provided to the Owner with two (2) electronic copies on USB flash drives. Test reports shall be in their original format as downloaded from the test equipment. Software to view the test results must be provided free of charge to the Owner. Additionally, this Contractor shall provide hardcopy documentation indicating cable length and the pass/fail test result for each Category 6 cable installed.
- E. Any outlet, cable or component that does not meet the required operational tests or fails to meet installation standards as specified shall be repaired or replaced by the Contractor as directed by, and at no expense to, the Owner.

### **3.07 DRAWINGS AND DOCUMENTATION**

- A. Fully detailed documentation and record drawings of installation layout and performance shall be submitted for review within thirty (30) days of completion of work and shall include as a minimum:
  - B. Marked drawings showing routing of all inside cable with gauge, type and numbering scheme.

- C. Location of outlets with their new identification number prepared on most recent installation drawing.
- D. Drawings shall accurately record actual locations of each item of fixed equipment and show interconnecting wiring. Drawings will indicate location of equipment and tagged circuits. A functional block diagram will also be required.
- E. Drawings, whenever submitted, shall be submitted with two (2) copies to the Owner.
- F. Final record drawings shall be submitted as two (2) sets of scaled drawings and two (2) USB flash drives in AutoCAD 2018 or higher format. Drawings shall be professionally done. Hand drawings and notations will not be accepted.
- G. Submit pictures of the equipment rooms, backboards, and rack elevations. Pictures must include room entry point, all surrounding walls, backboards, front rack elevations and rear rack elevations.
- H. All drawings and the information contained therein become the sole property of the Owner.

### **3.08 CLOSEOUT**

- A. Punch List
  1. The Contractor shall perform required remedial work, without claim for additional labor or other costs. Where required, the Contractor shall re-test and submit a revised Test Report.
  2. The Contractor shall notify the Technology Designer of completion of the Punch List.
  3. If after notification and inspection by the Technology Designer, the identified Punch List items have not been corrected the Contractor will be notified that remedial work is still required. Additional time spent by the Technology Designer, due to the failure of the Contractor to correct Punch List items and finish the project by the agreed upon completion date as set forth in the Contract Documents, will be charged to the Contractor at the rate of one hundred twenty-five dollars (\$125) per hour and deducted from the Contractors retainage.
  4. Fully detailed documentation, record drawings of the installation, cabinet layouts, and performance shall be submitted for review.
  5. Final payment/retainage will NOT be considered if all aspects of work have not been satisfied and approved by the Technology Designer.

### **3.09 THE OWNER'S RIGHT TO USE**

- A. Acceptance of the Work of this Section will occur after completion of corrections and adjustments required by "Punch List" (as generated during on-site inspections and review of testing documentation).
- B. The Owner reserves the right to use equipment, material and services provided as part of Work of this Section, prior to Acceptance, without incurring any obligation to accept any equipment or completed systems until Punch List work is complete and systems comply with Contract Documents.

**END OF SECTION**

---

## SECTION 31 1000 - SITE CLEARING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Protecting existing trees, shrubs and other vegetation to remain.
  - 2. Removing existing trees, shrubs and other vegetation.
  - 3. Clearing and grubbing.
  - 4. Stripping and stockpiling topsoil.
  - 5. Removing above-grade and below-grade site improvements.
  - 6. Disconnecting, capping or sealing, and abandoning site utilities in place or removing site utilities.
  - 7. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
  - 1. Division 31 2000 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.
  - 2. Division 32 9200 Section "Turfs and Grasses" for finish grading including preparing and placing planting soil mixes and testing of topsoil material.

#### 1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

---

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site unless otherwise noted on the plans.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings per Division 01 Sections.
  - 1. Identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Sections.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract. Contractor is to confirm that this authority has been obtained before beginning work on adjoining property.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

---

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 2000 Section "Earth Moving."
  - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site. Contractor is responsible for doing an independent earthwork computation and including all necessary import and/or export of materials in their bid.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction. If said points will be disturbed, establish new points prior to removal.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction and the sediment and erosion control drawings, whichever is more stringent.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls only after all areas are restored and stabilized.

### 3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.
  - 1. Do not store construction materials, debris, or excavated material within fenced area.
  - 2. Do not permit vehicles, equipment, or foot traffic within fenced area.
  - 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.





---

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

### 3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile topsoil material in locations approved by the Owner or Architect.

### 3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

### 3.8 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, other vegetation and waste materials including trash and debris, and legally dispose of them off Owner's property.

1. Burning of materials on project property is prohibited.

END OF SECTION 31 1000

This page intentionally left blank

---

## SECTION 31 1012 - FINE GRADING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

#### 1.2 SUMMARY

- A. Work included: All labor, materials, necessary equipment and services to complete the Fine Grading work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as not in contract on the plans.
- B. Related work specified elsewhere:
  - 1. Division 31 2000 Section "Earth Moving."
  - 2. Division 32 9200 Section "Turfs and Grasses."

#### 1.3 SITE INSPECTION

- A. The Contractor shall visit the site and acquaint himself with all existing conditions. The Contractor shall be responsible for his own subsurface investigations, as necessary, to satisfy requirements of this Section. All subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the Landscape Architect or Owner's Representative.

#### 1.4 UTILITIES

- A. Before starting site operations verify that the earlier Contractors have disconnected all temporary utilities which might interfere with the fine grading work.
- B. Locate all existing, active utility lines traversing the site and determine the requirements for their protection. Preserve in operating condition all active utilities adjacent to or transversing the site that are designated to remain.
- C. Observe rules and regulations governing respective utilities in working under requirements of this section. Adequately protect utilities from damage, remove or relocate as indicated, specified or required. Remove, plug or cap inactive or abandoned utilities encountered in excavation. Record location of active utilities.
- D. Contact "Miss Dig" for existing utilities survey confirmation.

#### 1.5 QUALITY ASSURANCE

- 
- A. Requirements of all applicable building codes and other public agencies having jurisdiction upon the work.
  - B. Primary emphasis should be given to the aesthetic appearance and functioning of berming and swales, as directed by the Landscape Architect or Owner's Representative. The Contractor shall employ skilled personnel and any necessary equipment to insure that finish grading is smooth, aesthetically pleasing, drains well and is ideal for receiving sod and plant materials.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Existing Soil:
  - 1. Strip existing topsoil for new construction unless otherwise directed by Owner's Representative, free from debris, sod, biodegradable materials and other deleterious materials. The Contractor shall insure that all existing soil has sufficient percolation and surface drainage to support grasses and plant material and that extreme compaction occurs only in areas to receive paving.
  - 2. In areas to receive seed, verify that soil is scarified to depth of 3 inches and that soil contains enough organic matter to support and encourage rooting of seeded lawn.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- B. Job Conditions
  - 1. Dust control: Use all means necessary to prevent dust from construction operations from being a nuisance to adjacent property owners and from damaging finish surfaces on adjacent building, paving, etc. Methods used for dust control are subject to approval by the Architect or Owner's Representative.
  - 2. Burning: On-site burning will not be permitted.
  - 3. Protection: Use all means necessary to protect curbs, gutters, sprinklers, utilities and vegetation designated to remain, and, in the event of damage, immediately make all repairs, replacements and dressings to damaged plants necessary to the approval of the Landscape Architect. Contractor shall incur all cost for the replacement of damaged objects and vegetation.

### 3.2 SCHEDULING

- A. Schedule all work in a careful manner with all necessary consideration for adjoining property owners and the public.
- B. Coordinate schedule with other Contractors to avoid conflicts with their work.

### 3.3 EXCAVATION

- A. Excavate where necessary to obtain subgrades, percolation and surface drainage as required.
- B. Materials to be excavated are unclassified.

- 
- C. Remove entirely any existing obstructions after approval by the Architect's or Owner's Representative.
  - D. Remove from site and dispose of debris and excavated material not required.

### 3.4 GRADING

- A. The Contractor shall establish finished grades as shown on the construction plans and as directed by the Architect, including areas where the existing grade has been disturbed by other work.
- B. Finished grading shall be smooth, aesthetically pleasing, drain well and ready to receive sod and other plant material to full satisfaction of the Owner's Representative, Architect and Construction Manager.

### 3.5 COMPACTION

- A. Compact each layer of fill in designated areas with approved equipment to achieve a maximum density at optimum moisture, AASHTO T 180 - latest edition.
  - 1. Under buildings, roadways, curbs, walks and other paved areas: compaction shall be to 95% of maximum density.
  - 2. Under landscaped area, compaction shall not exceed 85% of maximum density.
- B. No backfill shall be placed against any masonry or other exposed building surface until permission has been given by the Owner's Representative, and in no case until the masonry has been in place seven days.
- C. Compaction in limited areas shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than four inches thick. The hand tampers used shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent any wedging action against masonry or other exposed building surfaces.

### 3.6 CORRECTION OF GRADE

- A. Bring to required grade levels areas where settlement, erosion or other grade changes occur. Adjust grades as required to carry drainage away from buildings and to prevent ponding around the buildings and on pavements.
- B. Remove all rock or objectionable material larger than 1 inch in any direction prior to commencing landscaping.
- C. Contractor shall be responsible for stabilizing grades by approved methods prior to landscaping, and shall be responsible for correction of grades as mentioned above, and clean up of any wash outs or erosion.

END OF SECTION 31 1012

This page intentionally left blank

---

## SECTION 31 1018 - SOIL EROSION CONTROL

### PART 1 - GENERAL

#### 1.1 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

#### 1.2 SUMMARY

- A. The work under this Section includes, but not limited to all work necessary for effective soil erosion control in conformance with Part 91, Act 451, PA 1994, the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources Environmental Protection Act guidelines and all pertinent local enforcing agency rules and regulations, having jurisdiction.

B. Related Sections include the following:

- 1. Division 31 2000 Section "Earth Moving."

#### 1.3 STANDARDS

- A. General: Perform all work under this Section in accordance with all pertinent rules and regulations, including, but not necessarily limited to those mentioned above and these Specifications.
- B. Conflicts: Where provisions of pertinent rules and regulations conflict with these Specifications, the more stringent provisions shall govern.

### PART 2 - PRODUCTS

#### 2.1 SEED, FERTILIZER, MULCH

- A. Refer to other Specification Section in Part 3.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- 
- A. Standards: Provide all materials and promptly take all actions necessary to achieve effective erosion control in accordance with the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources guidelines, local enforcing agency guidelines and these Specifications.
  - B. Site evaluation: Prior to start of the Work, conduct a field evaluation of the site along with representatives of the Engineer/Architect and the local enforcing agency.
  - C. Permits: Contractor is responsible for obtaining all pertinent permits including a Soil Erosion Control Permit if required from the county or local enforcing agency. Submit the NPDES Notice of Coverage when the soil erosion permit is received if not already done.

### 3.2 SEEDING AND MULCHING

#### A. General

- 1. All bare soil, unless otherwise required by the Contract Documents, shall be seeded, fertilized and mulched to create a protected condition. Use seed mix as indicated on the plans (if different seed mixes are indicated on the civil and landscape plans, the mix indicated on the landscape plans shall override). Critical areas shall be sodded as approved by the Engineer/Architect and as shown on the plans.
- 2. Seeding and mulching shall be performed immediately upon completion of a phase or section of the Work or as approved by the Engineer/Architect.
- 3. In all cases, seeding and mulching shall be performed within thirty (30) calendar days from the time the area was first disturbed.
- 4. During any period of time which the soil is unprotected, provide erosion control structures as necessary to minimize erosion and to keep any eroded soils on the site and out of ditches, rivers, storm sewers and wetlands.
- 5. Refer to the plans for notes regarding the use of turf reinforcement matting and/or mulch blankets (on all slope exceeding 1 vertical to 10 horizontal).

B. Seed: Seed shall be applied uniformly at a minimum rate of 48 pounds per acre.

C. Fertilizer: Fertilizer shall be applied uniformly at a minimum rate of 250 pounds per acre.

D. Mulch: Mulch shall be uniformly applied at a rate of two (2) tons per acre, or equal, on all seeded areas that have a slope of less than 1 vertical to 10 horizontal. Refer to note A5. above for additional slope stabilization requirements.

### 3.3 DITCH AND RIVERS

- A. When reasonably possible, banks of ditches and rivers disturbed under this Work shall be protected within 24 hours of disturbance, but in no case shall banks be left unprotected more than 7 calendar days.

### 3.4 STEEP SLOPES



---

A. Emulsion

1. On slopes greater than 10%, use erosion control blankets or turf reinforcement matting to hold seed in place. Refer to plan notes.

B. Other methods: Chemical self-adhering mulch and other mulch anchoring methods may be used as approved by the Engineer/ Architect.

3.5 SITE IMPROVEMENTS CONSTRUCTION

A. During construction of the site improvements conform to the following general rules:

1. Minimize the amount of earth disturbed at any one time.
2. Establish a construction sequence which includes adequate erosion control.
3. Provide ground cover, even if only temporary, so as to stabilize an area and minimize erosion.
4. As much as practicable, direct storm water away from the construction area. Direct diverted storm water to any stable area.
5. Collect runoff from the site in sediment basins, traps or through filters.
6. Establish an inspection and maintenance schedule, paying special attention to the beginning of the various stages of construction. Employ a certified storm water operator and keep a log of the soil erosion and sedimentation control measures in accordance with the NPDES requirements.
7. Keep in mind that the primary objective is to keep the soil on the site.
8. Once final stabilization of the site is complete, and the governing agency has granted its approval, remove all temporary erosion control structures.
9. Control site runoff during all periods of site construction to ensure that excess surface runoff does not reach adjacent properties. This is especially critical during stages when the land has been stripped but not yet graded.

3.6 CLEANING

- A. Perform cleaning of all areas affected by work under this section and leave the site in a neat and tidy state. Contractor shall keep Adjacent Roads clean and free of debris.

END OF SECTION 31 1018

This page intentionally left blank

---

## SECTION 31 2000 - EARTH MOVING

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All earthwork operations shall conform to the current Michigan Department of Transportation standards and specifications.
- C. CAD files will be made available for use in construction staking. Contact the engineer regarding applicable fee and requirements for signing of the CAD File Transfer Agreement.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns, and plantings.
  - 2. Subbase course for concrete walks and pavements.
  - 3. Base course for asphalt paving.
  - 4. Excavation and backfill for utility trenches.
- B. Related Sections include the following:
  - 1. Division 31 1000 Section "Site Clearing" for site stripping, grubbing, removing topsoil, and protecting trees to remain.
  - 2. Division 32 9200 Section "Turfs and Grasses" for finished and fine grading, including placing and preparing topsoil for lawns and plantings.
  - 3. Division 33 4100 Section "Storm Sewers, Underdrains, and Drainage Structures" for storm drainage system.

#### 1.3 DEFINITIONS

- A. Backfill: Soil materials used to fill an excavation.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- F. Engineered Fill: Fill placed and compacted to densities specified herein, in a controlled manner

---

using lift thickness limited herein, monitored and tested by the Testing Agency or independent Geotechnical Inspector.

- G. Excavation: Removal of material encountered above subgrade elevations.
- H. Fill: Soil materials used to raise existing grades.
- I. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material 3/4 cu. yd. (0.57 cu. m) or more in volume.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subbase Course: Layer placed between the subgrade and base course for asphalt paving, or layer placed between the subgrade and a concrete pavement or walk.
- L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- M. Undercutting: Necessary excavation of poor quality soils which occur below the existing Topsoil and any uncontrolled fill soils as described in the Geotechnical Investigation.
- N. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Drainage fabric if required for the project .
  - 2. Separation fabric if required for the project.
- B. Test Reports: Testing Agency shall submit the following reports directly to the architect and shall copy the contractor:
  - 1. Analysis of soil materials, whether procured on or off site, and including fill, backfill, and borrow materials.
  - 2. In-place density test reports.
  - 3. Moisture-density relationship test reports.
  - 4. Compressive strength or bearing test reports.
- C. Material Test Reports: Interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Services

1. The Owner will secure and pay for the services of a qualified, independent geotechnical engineer to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing. Geotechnical engineer shall be acceptable to the architect and the owner and shall be licensed to practice in the state in which the project is located.

- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 3100 Section "Project Management and Coordination" for meetings.

## 1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect or Owner and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Owner not less than three (3) calendar days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's or Owner's written permission.
3. Contact utility-locator service for area where Project is located before excavating.

- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## PART 2 – PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials without additional cost to Owner when sufficient satisfactory soil materials are not available from excavations. Contractor is responsible for doing an independent earthwork calculation and including any import of appropriate fill material required to bring the site to the proposed grades.

- B. Satisfactory Soil Material (ASTM D 2487): Free of stones larger than 2 inches in any dimension, trash, debris, organic material, other objectionable material and classified as follows:

1. GP (poorly graded gravel).
2. GM (silty gravel).
3. GC (clayey gravel).
4. SW (well-graded sand).
5. SP (poorly graded sand).
6. SM (silty sand).

- C. Unsatisfactory Soil Material (ASTM D 2487):

1. SC (clayey sand).
2. CL (lean clay).
3. ML (silt).
4. OL (organic clay).

5. OL (organic silt).
6. CH (fat clay).
7. MH (elastic silt).
8. OH (organic clay).
9. OH (organic silt).
10. PR (peat).

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement. Refer to the plans for specific requirements.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement. Refer to the plans for specific requirements.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; Generally either an MDOT Class II sand or 21AA gravel will meet this requirement.

1. Clean granular fill meeting MDOT Class II grading requirements.
2. On-site granular deposits within the excavation can be used as engineered fill if approved by the geotechnical engineer and if selective excavation procedures are employed to manage existing clay deposits.
3. Import fill as required to make-up volumes necessary to raise the building site.
4. Refer to the plans for specific requirements.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; Generally either an MDOT 3G, 5G, 6A, or 34R will meet this requirement. Bedding requirements of the agencies having jurisdiction over the utility installation take precedence over these specifications.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; Generally either an MDOT 6A or 34R will meet this requirement. Refer to the plans for specific requirements.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 ACCESSORIES

A. Drainage Fabric: Nonwoven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods.

B. Separation Fabric: Woven geotextile, specifically manufactured for use as a separation geotextile; made from polyolefins, polyesters, or polyamides; with minimum properties determined according to ASTM D 4759 and referenced standard test methods.



- 
- A. Do not proceed with excavations for building structures until Subgrade Preparation operations are complete and tested.
  - B. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
    - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
    - 2. Pile Foundations: Stop excavations from 6 to 12 inches (150 to 300 mm) above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
    - 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended for bearing surface.
  - C. Coordinate excavations with Dewatering operations as required to allow construction of foundations to dry.

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

### 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit, unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms in accordance with the plans and standard details. Excavate trenches a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade.
  - 1. Excavate trenches a minimum 4 inches (100 mm) deeper than bottom of pipe elevation to allow for bedding course (excavate deeper as required by the regulating agency). Hand excavate for bell of pipe. Remove projecting stones and sharp objects along trench subgrade. Provide bedding course per the plan notes and/or details.

### 3.8 SUBGRADE PREPARATION AND INSPECTIONS

- A. Perform mass earthwork operations to remove all existing topsoil and other organic materials in their entirety within the footprint of the proposed building and pavement areas. Buried objects should be removed in their entirety.



- 
- B. Notify Testing Agency when excavations have reached required subgrade elevations.
  - C. Proof-roll subgrade in the presence of the Testing Agency to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
    - 1. Completely proof-roll subgrade in one direction repeating proof-rolling in direction perpendicular to the first direction. Limit vehicle speed to 3 mph.
    - 2. Proof-roll subgrade with heavy pneumatic-tired equipment or loaded 10-wheel, tandem-axle truck weighing not less than 15 tons.
    - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Testing Agency, and replace with engineered fill as directed.
  - D. If Testing Agency determines that unsatisfactory soil is present, continue excavations and replace with compacted backfill or fill materials as directed.
    - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
  - E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities.

### 3.9 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used at no additional cost to the Owner.

### 3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for record documents.
  - 3. Inspecting and testing underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.



1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 95 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill material at 88 percent.

### 3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  1. Provide a smooth transition between adjacent existing grades and new grades.
  2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish Subgrades to required elevations within plus or minus 1 inch.
- C. Grading Inside Grading Lines: Finish subgrade to a tolerance of ½ inch, when tested with a 10 foot straight-edge.
- D. Contractor shall confirm that the proposed grades shown on the plans will not create a ponding water condition (i.e. an unintended low spot or pavement grades of less than 1%).

### 3.17 SUBSURFACE DRAINAGE

- A. Drainage Piping: Drainage pipe is specified in Division 33 Section "Subdrainage" for foundation drainage and under-slab drainage systems.
- B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench. Place a 6 inch course of filter material on drainage fabric to support drainage pipe. Encase drainage in a minimum of 12 inches of filter material and wrap in a drainage fabric, overlapping sides and ends at least 6 inches.
  1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.
  1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.

### 3.18 SUBBASE AND BASE COURSES

- A. If indicated on the plans or deemed necessary by the geotechnical engineer, install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.



- 
- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
  - B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces becomes eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - C. Protect all existing trees, bushes, plants, etc. indicated to remain during construction activities.

### 3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Unless otherwise indicated on the drawings, remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.
  - 1. Do not burn materials on the Owner's property.

END OF SECTION 31 2000

This page intentionally left blank

---

## SECTION 32 1216 - HOT-MIX ASPHALT CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern

#### 1.2 SUMMARY

- A. This Section includes installation of the following:
  - 1. Hot-mix asphalt concrete paving.
- B. Related Sections include the following:
  - 1. Division 31 1415 Section "Pavement Marking."
  - 2. Division 31 2000 Section "Earth Moving" for aggregate subbase and base courses.

#### 1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. MDOT: Michigan Department of Transportation.

#### 1.4 REQUIREMENTS

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of MDOT'S most current Standard Specifications for Construction. Where notes in this specification section differ from the MDOT standards, the MDOT standards shall govern.
- B. 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.
- C. 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.

#### 1.5 SUBMITTALS

- A. Submit aggregate and bituminous mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer.
  - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.
- C. Regulatory Requirements: Comply with (MDOT) Michigan Department of Transportation's current Standard Specification for Construction for asphalt paving work.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
  - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
  - 2. Slurry Coat: Comply with weather limitations of ASTM D 3910.
  - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
  - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.
- B. Pavement-Marking Paint: Apply pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F (10 deg C) for water-based materials, and not exceeding 95 deg F.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Asphalt Cement: ASTM D 946.
- B. Aggregate for Base Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- C. Aggregate for Leveling Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- D. Aggregate for Wearing Course: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.



- 
- E. Fine Aggregate: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
  - F. Mineral Filler: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
  - G. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

## 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- B. Asphalt Cement: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- C. Prime Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- D. Prime Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.
- E. Tack Coat: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards.

## 2.3 AUXILIARY MATERIALS

- A. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- B. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.
- C. Pavement-Marking Paint: Refer to section 32 1415 "Pavement Marking".
  - 1. Color: As indicated on Drawings or in accordance with MDOT.
- D. Wheel Stops (if indicated): Precast, air-entrained concrete, 2500-psi minimum compressive strength, 6 inches high by 9 inches wide by 84 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
  - 1. Dowels: Galvanized steel, 3/4-inch diameter, 10-inch minimum length.

## 2.4 ASPHALT MIX DESIGNS

- A. Hot-Mix Asphalt: Conform with requirements of agency having jurisdiction. If paving is not subject to local review, conform with DOT standards:

---

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that compacted subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction. Proof-roll as indicated in "Earth Moving" section 31 2000.
- C. Verify that gradients and elevation of base are correct. Retain first subparagraph below, if applicable.

### 3.2 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
  - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch minimum or as indicated.
  - 1. Use hot-applied joint sealant to seal cracks and joints. Fill flush with surface of existing pavement and remove excess.

### 3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared compacted subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

### 3.4 HOT-MIX ASPHALT CONCRETE PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
  - 2. Place hot-mix asphalt surface course in single lift.
  - 3. Spread mix at minimum temperature of 250 deg F.
  - 4. Install work in accordance with Michigan Department of Transportation (MDOT)..
  - 5. Compact pavement by rolling to density specified. Re-roll as necessary to achieve even and smooth finish without roller marks.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

- 
- C. Promptly correct surface irregularities in paving course behind paver. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."

### 3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
  - 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- G. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.7 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Base Course: Plus or minus 1/2 inch.
  - 2. Surface Course: Plus 1/4 inch, no minus.

- 
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
1. Base Course: 1/4 inch.
  2. Surface Course: 1/8 inch.
  3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. Confirm minimum 1% slopes on asphalt pavement surfaces. Notify engineer prior to asphalt placement if minimum 1% slope is not met in any areas.

### 3.8 PAVEMENT MARKING

- A. Refer to specification section 32 1415 "Pavement Marking".

### 3.9 FIELD QUALITY CONTROL

- A. Testing and inspecting: Owner may secure a testing firm to perform and determine compliance with specified requirements and AI MS-2.

### 3.10 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 32 1216

---

## SECTION 32 1313 - CEMENT CONCRETE PAVEMENTS, CURBS AND GUTTERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern.

#### 1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
  - 1. Driveways and roadways.
  - 2. Parking lots.
  - 3. Curbs and gutters.
  - 4. Sidewalks and platforms.
  - 5. Wheel stops.
- B. Related Sections include the following:
  - 1. Division 31 1415 Section "Pavement Marking."
  - 2. Division 31 2000 Section "Earth Moving" for subgrade preparation, grading and subbase course.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Refer to MDOT's current Standard Specifications for Construction.

#### 1.4 SUBMITTALS

- A. Submit aggregate and concrete mix designs for review. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer with at least three (3) years in business who has completed pavement work similar in material, design, and extent to that indicated for this Project.

- 
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
    - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
  - C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
  - D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

## 1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. 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

### 2.1 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
  - 1. Use flexible or curved forms for curved conditions.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces.

### 2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated flat sheets, unfinished.
- B. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed billet steel, unfinished.
- C. Epoxy-Coated Reinforcement Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, deformed bars.
- D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

- 
- F. Epoxy-Coated Joint Dowel Bars: ASTM A 775/A 775M; with ASTM A 615/A 615M, Grade 60, plain steel bars.
  - G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
  - H. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
  - I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete.
  - J. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

### 2.3 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project. All material to meet current MDOT specifications.

### 2.4 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry where indicated on Contract Documents.
- B. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- C. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

### 2.5 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
  - 1. Thickness: ½ inch minimum and thicker where indicated.
- B. Coloring Agent: Where indicated, ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
  - 1. Color: n/a
- C. Wheel Stops (use only if indicated on the plans): Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 9 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate.
  - 1. Dowels: Galvanized steel, diameter of 3/4 inch, minimum length 18 inches.

- 
- D. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
  - E. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
  - F. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

## 2.6 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
- C. Proportion mixes to provide concrete for driveways, roads, parking lots, curbs and gutters with the following properties:
  - 1. Compressive Strength (28 Days): 3500 psi, unless otherwise indicated.
  - 2. Maximum Water-Cementitious Materials Ratio: 45% by weight.
  - 3. Maximum Aggregate Size: 1.5 inch (38 mm).
- D. Sidewalks and platforms provide 3500 psi.
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 to 8.5 percent.
- G. Use appropriate treatment per MDOT specifications where concrete will be placed under freezing conditions. Obtain approval of architect prior to placing concrete in freezing conditions.
- H. Coloring Agent: Where indicated, add coloring agent to mix according to manufacturer's written instructions.

## 2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
  - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.



---

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction and repair as required.
- B. Verify that grades are correct.

### 3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

### 3.3 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- C. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

### 3.4 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
- B. At all locations where new concrete abuts existing concrete, building wall, or supported slabs, place expansion joint and joint sealant.
- C. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
  - 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

- 
- D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where required.
1. Terminate joint filler 1 inch below finished surface to allow placement of joint sealant.
  2. Joint sealant is required for all projects even if not indicated on the plans.
- E. Expansion Joints: Place 1 inch (25 mm) wide expansion joints at maximum 40 foot intervals, if not indicated on drawings. Joints to be full depth of pavement. Place joint sealant at all expansion joints.
- F. Install dowel bars and support assemblies at joints if indicated on the plans. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- G. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas. Construct ¼ inch wide contraction joints for a depth equal to at least one-third of the concrete thickness. Maximum spacing of contractions joints shall be 8'.
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 3/8-inch (10-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
  3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- H. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius.
1. Radius: 3/8 inch (10 mm).

### 3.5 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
- E. Cold-Weather Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

- 
- F. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R when hot-weather conditions exist.

### 3.6 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots.
1. Area Paving: Light broom, texture perpendicular to pavement direction.
  2. Curbs and Gutters: Light broom, texture parallel to pavement direction.
  3. Direction of Texturing: Parallel to pavement direction.
  4. Inclined Vehicular Ramps: Heavy broomed perpendicular to slope.
  5. Place sealer on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
- C. Provide detectable warning surface at all handicap ramps to meet ADA requirements in accordance with ANSI sections 406.13 and 705.

### 3.7 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions.
- C. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions.

### 3.8 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
1. Elevation Variation: 1/4 inch.

- 
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  3. Surface Variation: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
  4. Maximum cross slope for walks, ramps, platforms: 2%
  5. Maximum longitudinal walk slopes not requiring landings and handrails: 5%
  6. Maximum longitudinal ramp slopes: 8.33% (1 on 12 slope)

### 3.9 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
  1. If indicated on the plans, spread glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified.
- B. Testing Services: Testing shall be performed according to the following requirements:
  1. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
  2. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
- C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

E  
C  
C  
S

32 1313 C P, C G

P N. 1622

P 9

---

3.11 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements as directed by the Architect.
- B. Remove and replace concrete sidewalks and/or ramps that do not comply with maximum slopes indicated in Section 3.8A above.
- C. Protect concrete from damage. Exclude traffic from pavement for at least fourteen (14) calendar days after placement.

END OF SECTION 32 1313

This page intentionally left blank

---

## SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All paving materials and construction methods shall conform to the current standards and specifications of the Michigan Department of Transportation. Where these specifications are less stringent than the requirements of MDOT, the MDOT standards shall govern

#### 1.2 SUMMARY

- A. General – all expansion joints are to receive joint sealant. Contraction and other joints receive sealant only if indicated on the plan.
- B. This Section includes the following:
  - 1. Expansion and contraction joints within cement concrete pavement.
  - 2. Joints between cement concrete and asphalt pavement.
- C. Related Sections include the following:
  - 1. Division 32 Section "Hot-Mix Asphalt Concrete Paving" for constructing joints between concrete and asphalt pavement.
  - 2. Division 32 Section "Cement Concrete Pavements, Curbs and Gutters" for constructing joints in concrete pavement.

#### 1.3 SUBMITTALS

- A. Product Data, shop drawing submittals are not required. Contractor shall confirm that the materials provided meet the required specifications, and provide material certification to the engineer. Material certification shall state that the products meet or exceed the requirements indicated on the plans and the requirements of the regulating authority.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

---

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

## 1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  - 2. When joint substrates are wet or covered with frost.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Use products meeting MDOT's current specifications.

### 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Gray.

### 2.3 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
  - 1. Products:
    - a. Crafcoc Inc.; RoadSaver Silicone.
    - b. Dow Corning Corporation; 888.
    - c. Approved equal.



- 
- B. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Products:
  - a. Crafcoc Inc.; RoadSaver Silicone SL.
  - b. Dow Corning Corporation; 890-SL.
  - c. Approved equal.

## 2.4 HOT-APPLIED JOINT SEALANTS

- A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Products:
  - a. Crafcoc Inc.; Superseal 444/777.
  - b. Meadows, W. R., Inc.; Poly-Jet 3406.
  - c. Approved equal.

- B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Products:
  - a. Koch Materials Company; Product No. 9005.
  - b. Koch Materials Company; Product No. 9030.
  - c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
  - d. Approved equal.

## 2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

---

## 2.6 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of backer materials.
  - 2. Do not stretch, twist, puncture, or tear backer materials.
  - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses provided for each joint configuration.

---

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

### 3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 1373

This page intentionally left blank

---

## SECTION 33 4100 - STORM SEWERS, UNDERDRAINS AND DRAINAGE STRUCTURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section. Where these specifications differ from the local or City's standard detail sheets, the detail sheets shall govern.

#### 1.2 SUMMARY

- A. The work under this Section includes, but is not necessarily limited to, the furnishing and installation of all storm sewers, underdrains and drainage structures and leads and connections as indicated on the Drawings, herein specified and as necessary for the proper and complete performance of this Work for foundations and underslab areas.
  - 1. Storm Sewer Pipe
  - 2. Culverts
  - 3. Perforated Underdrain Pipe
  - 4. Castings
  - 5. Manhole Sections and Steps
  - 6. Catch Basin
  - 7. Brick and Concrete Block Masonry
- B. Related Sections may include, but not be limited to, the following:
  - 1. Division 31 2000 Section "Earth Moving" for excavation and backfill.

#### 1.3 QUALITY ASSURANCE

- A. Use only personnel completely trained and experienced in installation of the materials.
- B. Compliance to City/Township Codes and all other agencies having jurisdiction shall govern material and installation procedures.

#### 1.4 SUBMITTALS

- A. Shop Drawings: Shop drawing submittals are not required for storm sewer materials. Contractor is expected to conform to the plans, specifications, and details for this work. Submit material certificates in lieu of shop drawings. Material certificates shall be signed by manufacturer and contractor certifying that each material item complies with or exceeds requirements.

#### 1.5 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect the materials before, during and after installation.
- B. Replacements: In the event of damage, immediately make all necessary repairs and replacements acceptable

---

to the Engineer and at no additional cost to the Owner.

## PART 2 - PRODUCTS

### 2.1 STORM SEWER PIPE

- A. General: Storm sewer pipe material shall be as indicated on the plans. If indicated on the plans, pipe materials shall conform to the following requirements.
- B. Reinforced Concrete Pipe
1. Reinforced concrete pipe shall conform to ASTM C-76.72A, Type IV.
  2. Joints shall be premium rubber joint as acceptable to the Engineer unless otherwise specified on the drawings.
- C. Corrugated Polyethelene Tubing (CPT)
1. Corrugated Polyethelene Tubing (CPT) shall conform to ASTM F405 and shall be perforated with sock where indicated on the plans.
  2. Joints shall be secured with a factory made snap-on or screen-on coupler for 4" and 6" diameter. Joints for 8" diameter and larger shall be a factory made coupler ties, bolts or screws on.
- D. Smooth Lined Corrugated Polyethylene Pipe (SLCPP)
1. Corrugated polyethylene pipe shall have a smooth interior wall, Manning's "n" of 0.012 or better and shall conform to AASHTO M294.
  2. Joints shall be secured with a tied or bolted polyethylene coupler or shall be a factory made coupler which can be screw turned on to the end corrugations.
  3. Corrugated polyethylene pipe shall be Advanced Drainage Systems N-12, Hancor HiQ or accepted equal.

### 2.3 PERFORATED UNDERDRAIN PIPE (PE or CPP)

- A. General
1. Perforated underdrain pipe shall be perforated, corrugated polyethelene pipe.
  2. The pipe shall have a factory installed geotextile pipe wrap.
  3. Perforation shall meet the requirements of AASHTO M 278.
- B. Polyethylene Pipe (PE): Polyethylene pipe and fittings shall be standard strength and conform to ASTM F 405 and AASHTO M 252.
- C. Polyvinyl Chloride Pipe (PVC): Polyvinyl Chloride pipe and fitting shall be standard strength and conform to ASTM F 800.

- 
- D. Geotextile Pipe Wrap: Geotextile pipe wrap shall weigh at least 3.5 ounces per square yard and shall conform to AASHTO M 288. It shall not be ripped or torn. The minimum tensile strength shall be 100 pounds.

## 2.4 CASTINGS

- A. General: All castings shall be of cast iron, conforming to ASTM A 48 unless otherwise indicated. Conform to details and notes indicated on the plans. Where details or notes are not indicated, conform with the following requirements.
- B. Manhole frames and covers: Material shall be MDOT Type A with perforated covers.
- C. Catch basins and inlet castings: Catch basin and inlet castings shall be MDOT Type K when located in curbs and gutter, MDOT Type E in non-paved locations, and MDOT Type A when located in paved areas.

## 2.5 MANHOLE SECTIONS

- A. Manhole walls
  - 1. Standard manhole walls shall be Precast concrete units conforming to ASTM C 478, or be concrete block masonry.
- B. Manhole bases: Manhole bases shall be precast concrete units of the dimensions indicated on the Drawings.

## 2.6 MANHOLE STEPS

- A. Manhole steps shall be of cast iron conforming to ASTM A 48 or equal, and shall meet pertinent safety rules and regulations.

## 2.7 CATCH BASINS

- A. Construct catch basins of brick, block, masonry, or Precast units. Precast concrete catch basin units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

## 2.8 INLETS

- A. Construct inlets of brick, block, masonry, or Precast units. Precast inlet units, if used, shall have reinforcing steel conforming to ASTM C 76 II, Wall B.

## 2.9 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

## 2.10 MORTAR

- A. Mortar for brick masonry or plastering manholes shall be made of one part Portland cement to two parts sand,





---

B. Handling

1. Distribute pipe and materials at the site as required, care to prevent damage to the pipe and materials.
2. Use proper tools and implements for safely handling and installing the pipe and other materials.
3. Protect the pipe and other materials from falling to the ground or into the trench.
4. Protect distributed pipe and materials from the public and passing vehicles.

C. Laying pipe

1. Lay all pipe true to line and grade with pipe ends abutting each other and the bell end facing the direction of laying.
2. Use laser alignment equipment to establish and maintain proper line and grade, unless otherwise directed.
3. Correct any deviation from line and grade at no additional cost to the Owner.
4. Protect workers at all times from cave-in and other hazardous conditions.

D. Joints: Inspect each joint immediately after being completed and, if defective, shall be corrected before any more pipe is laid.

E. Concrete encasement

1. Place concrete encasements in locations and to the form and dimensions indicated.
2. Concrete for encasements shall be Class SE with that below the pipe dry mixed.
3. Take particular care to place the concrete under the pipe, and lay pipe in fresh concrete so that a complete support of the pipe will be made. Encasement at the sides and top may be placed after the concrete under this pipe has been set.

F. Manholes

1. Construct manholes as indicated on the Drawings and Specifications.
2. Take special care in forming the channels in the concrete bottom and use wooden templates or half sewer pipe for this work.
3. Plaster masonry work and castings as indicated on the Drawings.
4. In precast concrete manholes, the bottom section shall have cast openings of sufficient size to receive the sewer pipe. If such openings are not provided, the bottom portion may be constructed of masonry work from the concrete base to at least 6" above the top of the largest pipe entering the manhole and Precast sections placed from the masonry to the desired top elevation.
5. All the annular space between the sewer pipe and the opening in the manhole section shall be filled with brick and/or masonry to provide a waterproof seal.
6. Place the manhole casting on a minimum of 3 courses of masonry brick and a maximum of 5 courses of manhole brick. Install bricks radially. Precast concrete adjusting rings may be used in place of brick.
7. Mortar joints have to be smooth tooled joints.

G. Catch basins and inlets

1. Construct catch basins and inlets as indicated on the Drawings and Specifications.
2. Place catch basin and inlet castings on a minimum of 3 courses of manhole brick and a maximum of 5 courses of manhole brick. Install brick radially. Precast concrete adjusting rings may be used in place of brick.

H. Trench bracing: Install trench bracing in accordance with safety and other pertinent rules and regulations, and Division 31 Section "Earth Moving."

I. Erosion control and sedimentation: Contractor to provide erosion control to minimize introduction of sedimentation into the system.

### 3.4 CLEANING

A. Prior to acceptance of storm sewers, underdrains, manholes and drainage structures, thoroughly clean those structures and remove all dirt and debris of whatever nature from inside sewer pipes, manholes and the like, and leave the site in a neat and clean condition.

END OF SECTION 33 4100