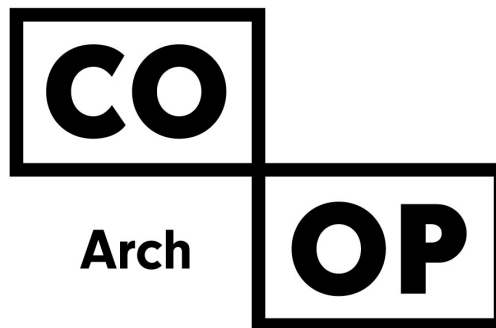


**This project manual provides for liquidated damages in the amount of \$500.00 per calendar day for the contractor's delay in completion of the work. See Bid Form, Agreement for Construction, Article 10 of the General Conditions for details.**

# **PROJECT MANUAL**

## **Diesel Addition & Remodel Lake Area Technical College Watertown, SD**

**CO-OP PROJECT NO. 2104**



**DIESEL ADDITION & REMODEL  
LAKE AREA TECHNICAL COLLEGE  
WATERTOWN, SD**

CO-OP Architecture Project No. 1823

November 04, 2021

Project Contacts:

Owner: Lake Area Technical College  
Contact: Mr. Shane Ortmeier  
Director of Support Operations  
Watertown, SD 57201  
Ph: 605-882-5284 #318

Architect: CO-OP Architecture  
Mr. Jason Kann, AIA  
440 East 8th St.  
Suite 221  
Sioux Falls, SD 57103  
Ph: 605-334-9999

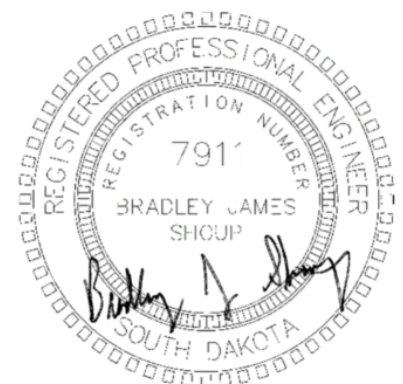
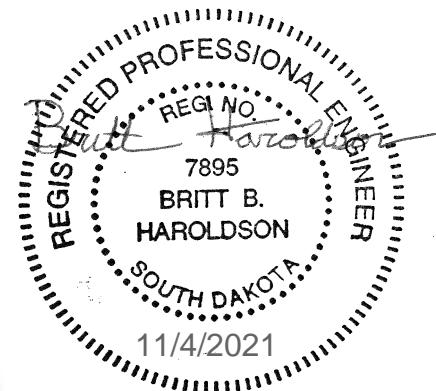
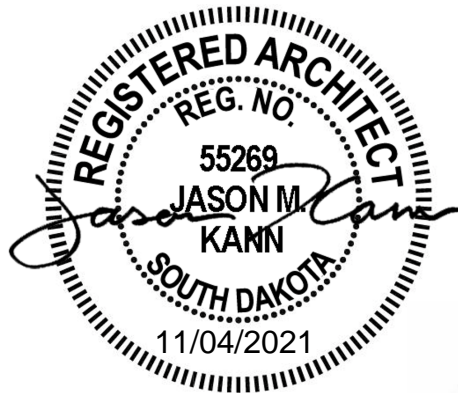
Landscape Architect: Confluence  
Mr. Lyle Pudwill, ASLA, PLA  
524 N Main Ave #201  
Sioux Falls, SD 57104  
Ph: 605-339-1205

Civil Engineer: Helm & Associates  
Mr. Lucas Hoover, PE  
221 Highway 19  
Aberdeen, SD 57401  
Ph: 605-225-1212

Structural Engineer: Heyer Engineering  
Mr. Britt Haroldson, P.E.  
436 E 8th St  
Sioux Falls, SD 57103  
Ph: 605-370-6139

Mechanical Engineer: Sichmeller Engineering  
Mr. Travis Sichmeller, P.E.  
801 Railroad Ave. SE  
Aberdeen, SD 57401  
Ph: 605-225-4344

Electrical Engineer: Associated Consulting Engineering, Inc.  
Mr. Brad Shoup, P.E.  
340 South Phillips Ave  
Sioux Falls, SD 57104  
Ph: 605-335-3720



## **LIQUIDATED DAMAGES**

The anticipated construction schedule is as follows:

Commencement of Contract: **on or near December 14, 2021**

Commencement of Construction: **May 16, 2022**

Certificate of Substantial Completion: **July 28, 2023**

Final Completion: **August 8, 2023**

FOR EACH DAY PAST THE SUBSTANTIAL COMPLETION DATE, THE DELINQUENT PRIME CONTRACTOR SHALL PAY TO THE OWNER AS A PENALTY BY REASON OF FAILURE OF THE PRIME CONTRACT TO COMPLETE THE WORK REQUIRED OF HIM/HER WITHIN THE AGREED UPON PROGRESS SCHEDULE, A DAILY SUM BASED UPON THE FOLLOWING SCHEDULE:

**(\$500 per calendar day) from July 28, 2023 thru SUBSTANTIAL COMPLETION.**

THE PENALTY ASSESSED HEREUNDER NEITHER SHALL BE IN LIEU OF, NOR SHALL AFFECT ANY OTHER REMEDIES AVAILABLE TO THE OWNER AS A RESULT OF THE FAILURE TO COMPLETE THE WORK WITHIN THE AGREED UPON PROGRESS SCHEDULE. TIME IS OF THE ESSENCE IN CONSTRUING THE TERMS OF THE CONTRACT AND A MATERIAL CONSIDERATION THEREOF. THE PARTIES AGREE THAT DAMAGES IN THE EVENT OF CONTRACTORS BREACH WOULD BE DIFFICULT TO CALCULATE, AND THAT THE FOREGOING IS A FAIR AND REASONABLE ESTIMATE OF THE DAMAGES SUFFERED BY THE OWNER IN THE EVENT OF SUCH BREACH.

THE TIME FOR COMPLETION OF ALL ARCHITECT/ENGINEER/OWNER PUNCHLIST ITEMS SHALL NOT BE LATER THAN:

**7 working days beyond SUBSTANTIAL COMPLETION.**

FOR EACH DAY PAST THE ABOVE DATE, THE DELIQUENT PRIME CONTRACTOR SHALL PAY TO THE OWNER THE FOLLOWING SUM:

**\$250 PER DAY**

THE PENALTY ASSESSED HEREUNDER NEITHER SHALL BE IN LIEU OF, NOR SHALL AFFECT ANY OTHER REMEDIES AVAILABLE TO THE OWNER AS A RESULT OF THE FAILURE TO COMPLETE THE WORK WITHIN THE AGREED UPON PROGRESS SCHEDULE. TIME IS OF THE ESSENCE IN CONSTRUING THE TERMS OF THE CONTRACT AND A MATERIAL CONSIDERATION THEREOF. THE PARTIES AGREE THAT DAMAGES IN THE EVENT OF CONTRACTORS BREACH WOULD BE DIFFICULT TO CALCULATE, AND THAT THE FOREGOING IS AIR AND REASONABLE ESTIMATE OF THE DAMAGES SUFFERED BY THE OWNER IN THE EVENT OF SUCH BREACH.

## **TABLE OF CONTENTS**

Liquidated Damages

Title Sheet

Table of Contents

Index of Drawings

Bidding Information Requirements:

Notice to Bidders

Form of Proposal

Instructions to Bidders & General Conditions:

Instructions to Bidders- AIA Document A701

General Conditions- AIA Document A201

Supplement to Instructions to Bidders

Supplement to General Conditions

Soil Investigation Data

### **DIVISION 01 - GENERAL REQUIREMENTS**

011000	SUMMARY
012000	PRICE AND PAYMENT PROCEDURES
012200	UNIT PRICES
013000	ADMINISTRATIVE REQUIREMENTS
013216	CONSTRUCTION PROGRESS SCHEDULE
014000	QUALITY REQUIREMENTS
014523	QUALITY CONTROL – TESTING AND INSPECTING SERVICES
015000	TEMPORARY FACILITIES AND CONTROLS
016000	PRODUCT REQUIREMENTS
017000	EXECUTION AND CLOSEOUT REQUIREMENTS
017800	CLOSEOUT SUBMITTALS
017900	DEMONSTRATION AND TRAINING

### **DIVISION 02 - DEMOLITION**

024100	DEMOLITION
--------	------------

### **DIVISION 03 - CONCRETE**

030505	UNDERSLAB VAPOR BARRIER
031000	CONCRETE FORMING AND ACCESSORIES
032000	CONCRETE REINFORCING
033000	CAST-IN-PLACE CONCRETE
033511	CONCRETE FLOOR FINISHES
034113	PRECAST CONCRETE HOLLOW CORE PLANKS
034500	PRECAST ARCHITECTURAL CONCRETE

### **DIVISION 04 - MASONRY**



042000 UNIT MASONRY

#### **DIVISION 05 - METALS**

051200 STRUCTURAL STEEL FRAMING  
052100 STEEL JOIST FRAMING  
053100 STEEL DECKING  
054000 COLD-FORMED METAL FRAMING  
055000 METAL FABRICATIONS  
055213 PIPE AND TUBE RAILINGS

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

061000 ROUGH CARPENTRY  
064100 ARCHITECTURAL WOOD CASEWORK  
068316 FIBERGLASS REINFORCED PANELING

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

072100 THERMAL INSULATION  
072500 WEATHER BARRIERS  
074213 METAL WALL PANELS  
075323 ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING (EPDM)  
076200 SHEET METAL FLASHING AND TRIM  
078400 FIRESTOPPING  
079005 JOINT SEALERS  
079513 EXPANSION JOINT COVER ASSEMBLIES

#### **DIVISION 08 - OPENINGS**

081113 HOLLOW METAL DOORS AND FRAMES  
081416 FLUSH WOOD DOORS  
083100 ACCESS DOORS AND PANELS  
083400 SPECIAL FUNCTION DOORS  
084313 ALUMINUM-FRAMED STOREFRONTS  
087100 DOOR HARDWARE  
088000 GLAZING

#### **DIVISION 09 - FINISHES**

092116 GYPSUM BOARD ASSEMBLIES  
092216 NON-STRUCTURAL METAL FRAMING  
093000 TILING  
095100 ACOUSTICAL CEILINGS  
096500 RESILIENT FLOORING  
096700 FLUID-APPLIED FLOORING  
096813 TILE CARPETING

099000 PAINTING AND COATING

**DIVISION 10 - SPECIALTIES**

101101 VISUAL DISPLAY BOARDS  
101400 SIGNAGE  
102113.19 PLASTIC TOILET COMPARTMENTS  
102239 FOLDING PANEL PARTITIONS  
102601 WALL AND CORNER GUARDS  
102800 TOILET, BATH, AND LAUNDRY ACCESSORIES  
104400 FIRE PROTECTION SPECIALTIES

**DIVISION 11 - EQUIPMENT**

115213 PROJECTION SCREENS

**DIVISION 12 - FURNISHINGS**

122400 WINDOW SHADES  
123600 COUNTERTOPS

**DIVISION 14 – CONVEYING EQUIPMENT**

146000 BRIDGE CRANES AND HOISTING EQUIPMENT

**DIVISION 21 – FIRE PROTECTION**

211000 FIRE SUPPRESSION SYSTEMS

**DIVISION 22 – PLUMBING**

220500 GENERAL PLUMBING REQUIREMENTS  
220510 BASIC PLUMBING MATERIALS AND METHODS  
220700 PLUMBING SYSTEMS INSULATION  
224000 PLUMBING

**DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING (HVAC)**

230500 GENERAL HVAC REQUIREMENTS  
230510 BASIC HVAC MATERIAL AND METHODS  
230593 TESTING, ADJUSTING, AND BALANCING (AIR & WATER)  
230700 HVAC SYSTEMS INSULATION  
230900 CONTROLS & CONTROL SEQUENCES  
232113 HYDRONIC PIPING SYSTEMS  
232123 HVAC HYDRONIC PUMPS  
237000 VENTILATION AND AIR CONDITIONING

**DIVISION 26 – ELECTRICAL**

260100	COMMON ELECTRICAL REQUIREMENTS
260500	BASIC ELECTRICAL MATERIALS AND METHODS
260600	GROUNDING AND BONDING
261200	CONDUCTORS AND CABLES
261300	RACEWAYS AND BOXES
261400	WIRING DEVICES
261450	LIGHTING CONTROL DEVICES
262890	SURGE PROTECTION DEVICES
264100	ENCLOSED SWITCHES
264200	ENCLOSED CONTROLLERS
264420	PANELBOARDS
264610	DRY-TYPE TRANSFORMERS
264910	FUSES
265110	INTERIOR LIGHTING

#### **DIVISION 27 – COMMUNICATIONS**

277400	COMMUNICATION & DATA-PROCESSING EQUIPMENT
--------	---

#### **DIVISION 28 – ELECTRONIC SAFETY AND SECURITY**

287210	FIRE ALARM
--------	------------

#### **DIVISION 01 – GENERAL REQUIREMENTS (CIVIL)**

013223	SURVEY AND LAYOUT DATA
017329	CUTTING AND PATCHING

#### **DIVISION 02 – EXISTING CONDITIONS (CIVIL)**

020100	MAINTENANCE OF EXISTING CONDITIONS
023000	SUBSURFACE INVESTIGATION

#### **DIVISION 03 – CONCRETE (CIVIL)**

031100	CONCRETE FORMWORK
031500	CONCRETE JOINTS AND WATERSTOPS
032000	CONCRETE REINFORCEMENT
033000	CAST-IN-PLACE CONCRETE

#### **DIVISION 31 – EARTHWORK**

312300	EXCAVATION AND FILL
312311	WATERING FOR EMBANKMENTS
312314	SHEETING, SHORING, AND BRACING
312333	TRENCHING, BACKFILLING, AND COMPACTING
313419	GEOTEXTILE FABRICS

## **DIVISION 32 – EXTERIOR IMPROVEMENTS**

321123	AGGREGATE MATERIAL
321213.13	BITUMINOUS TACK COAT
321216	ASPHALT CONCRETE SURFACING
321126.16	MILLING/PULVERIZATION OF EXISTING ASPHALT SURFACE AND BASE
321600	CURBS, GUTTERS, SIDEWALKS AND DRIVEWAYS
329219	SEEDING
329300	PLANTS

## **DIVISION 33 – UTILITIES**

330100	EXISTING UNDERGROUND UTILITIES
333100	SANITARY SEWER PIPING AND FITTINGS
333913	MANHOLES AND CASTINGS
334100	STORM UTILITY DRAINAGE PIPING

## LIST OF DRAWING SHEETS

### CODE

- G000 GENERAL NOTES, CODE & ORIENTATION PLAN
- G001 CODE STANDARDS
- G002 ASSEMBLY TYPE REVIEW

### CIVIL

- C100 TOPOGRAPHIC SURVEY
- C101 CIVIL SITE REMOVALS
- C102 PLAN NOTES SHEET
- C103 CIVIL SITE PLAN SURFACING AND DIMENSIONS
- C104 SITE GRADING PLAN
- C105 CIVIL SITE UTILITIES PLAN
- C106 DETAIL SHEET
- C107 DETAIL SHEET
- C108 STORM WATER POLLUTION PREVENTION PLAN
- C109 STORM WATER POLLUTION PREVENTION PLAN
- C110 STORM WATER POLLUTION PREVENTION PLAN

### LANDSCAPE

- L101 PLANTING PLAN AND DETAILS

### ARCHITECTURAL

- D100 OVERALL DEMOLITION PLAN
- D110 OVERALL CEILING DEMOLITION PLAN
- A100 OVERALL FLOOR PLAN
- A105 ROOF PLAN
- A110 REFLECTED CEILING PLANS
- A200 EXTERIOR ELEVATIONS
- A300 BUILDING SECTIONS
- A310 WALL SECTIONS
- A311 WALL SECTIONS
- A320 STAIR SECTIONS & DETAILS
- A321 STAIR DETAILS
- A400 ENLARGED PLANS & INTERIOR ELEVATIONS
- A401 ENLARGED PLANS & INTERIOR ELEVATIONS
- A402 ENLARGED PLANS & INTERIOR ELEVATIONS
- A500 EXTERIOR DETAILS
- A501 EXTERIOR DETAILS
- A510 INTERIOR DETAILS
- A511 INTERIOR DETAILS
- A600 DOOR & WINDOW SCHEDULE
- A601 FINISH SCHEDULE & LEGENDS

## **MECHANICAL**

**M100 MOTOR SCHEDULE, LEGEND & SHEET INDEX**  
**M200 MECHANICAL SITE PLAN**  
**M201 MECHANICAL ROOF PLAN**  
**M300 MECHANICAL DEMO - CLASSROOM ADDITION & REMODEL AREA**  
**M301 MECHANICAL DEMO - SHOP REMODEL**  
**M302 MECHANICAL DEMO - SHOP REMODEL**  
**M400 BELOW GRADE PLUMBING - SHOP ADDITION**  
**M401 BELOW GRADE PLUMBING - SHOP REMODEL**  
**M402 BELOW GRADE PLUMBING - OFFICE & CLASSROOM REMODEL & WASH BAY**  
**M500 ABOVE GRADE PLUMBING & HYDRONICS - SHOP ADDITION & MEZZ**  
**M501 ABOVE GRADE PLUMBING & HYDRONICS - SHOP ADDITION & MEZZ**  
**M502 ABOVE GRADE PLUMBING & HYDRONICS - OFFICE & CLASSROOM REMODEL & WASH BAY**  
**M600 FIRE PROTECTION PLAN - LEGENDS, DETAILS & DEMO**  
**M601 FIRE PROTECTION - SHOP ADDITION & MEZZ**  
**M602 FIRE PROTECTION - SHOP REMODEL & EXISTING PIPE**  
**M603 FIRE PROTECTION - OFFICE & CLASSROOM REMODEL & WASH BAY**  
**M700 HVAC PLAN - SHOP ADDITION & MEZZ**  
**M701 HVAC PLAN - SHOP REMODEL & MEZZ**  
**M702 HVAC PLAN - OFFICE & CLASSROOM REMODEL & WASH BAY**  
**M800 PLUMBING FIXTURE SCHEDULE**  
**M801 MECHANICAL DETAILS**  
**M802 MECHANICAL DETAILS CONTINUED**  
**M803 MECHANICAL SECTIONS**  
**M804 MECHANICAL SECTION CONTINUED**  
**M805 MECHANICAL SCHEDULES**

## **ELECTRICAL**

**ED100 OVERALL DEMOLITION PLAN - ELECTRICAL**  
**ED101 ENLARGED DEMOLITION PLANS - ELECTRICAL**  
**E100 OVERALL FLOOR PLAN - ELECTRICAL**  
**E200 ENLARGED FLOOR PLAN - ELECTRICAL**  
**E201 ENLARGED FLOOR PLAN - POWER & SIGNAL**  
**E202 ENLARGED REMODEL FLOOR PLAN - LIGHTING**  
**E203 ENLARGED REMODEL FLOOR PLAN - POWER & SIGNAL**  
**E204 ENLARGED FLOOR PLAN - LIGHTING**  
**E205 ENLARGED FLOOR PLAN - POWER & SIGNAL**  
**E300 ELECTRICAL SYMBOLS AND ABBREVIATIONS**  
**E301 ELECTRICAL SCHEDULES**  
**E302 ELECTRICAL SCHEDULES**  
**E303 ELECTRICAL SCHEDULES**

## NOTICE TO BIDDERS

Sealed bids will be received by the School Board of the Watertown School District No. 14-4 of Codington County, South Dakota for the complete construction (general, mechanical and electrical) for the proposed addition and renovations related to the **LATC Diesel Addition & Renovations on the Campus of Lake Area Technical College** until **2:00 p.m., local time on December 2nd, 2021**. The bid letting will be held at the Lake Area Technical College Student Center Administrative Offices (Room 431), 1201 Arrow Avenue, Watertown, South Dakota. A pre-bid meeting will be held at the site in the Diesel Technology building (Room 962/964), November 18th, 2021 at 2:00 p.m., local time.

Copies of the Plans and Specifications will be made available electronically (pdf format) and printed at the bidder's own expense. Technical questions shall be directed to CO-OP Architecture, LLC, Sioux Falls, South Dakota at 605-334-9999.

Bids shall be submitted to the Watertown School Board in a sealed envelope with the name and address of the bidder clearly identified on the envelope and the words "Bid for LATC Diesel Additions & Renovations". All bidders shall take note of the AIA Document A701 "Instructions to Bidders", and the AIA Document A201 "General Conditions of the Contract for Construction". Faxed bids will not be accepted; nor, will faxed bid adjustments be accepted. One combined bid will be accepted for complete construction (all general, mechanical, electrical, material and labor) as required to provide a complete project.

No bidder may withdraw a bid for 30 days following the bid opening without a written request explaining the cause of the withdrawal and without written consent of the Owner after reviewing the cause.

Liquidated damages shall be in effect for this project. See Bid Form, Agreement for Construction and the General Conditions for details.

Each bid shall be accompanied by a certified check, a cashier's check or draft certified or issued by a state or national bank, in the amount of at least five percent (5%) of the total amount of the bid, payable to the Watertown School District; or in lieu thereof, bidder may furnish a bid bond in the amount of not less than ten percent (10%) of the amount of the bid, such bond to be issued by a surety authorized to do business in the State of South Dakota and payable to the Watertown School District as a guarantee that such bidder will enter into a contract with the School District for the work described in the bid and as specified.

The Watertown School Board reserves the right to reject any part of, or all bids, and to waive any informalities or irregularities therein.

By virtue of statutory authority preference will be given to contracts, labor, materials, products and supplies found or produced with the State of South Dakota in a manner provided by law.

WATERTOWN SCHOOL DISTRICT NO. 14-4  
of Codington County, South Dakota

By: Heidi Clausen  
Business Manager

Publish twice at the total approximate cost of \$\_\_\_\_\_.

Please Publish: November 8, 2021

November 15, 2021

## BID FORM

PROJECT: Diesel Addition & Remodel

TO: Lake Area Technical College  
1201 Arrow Avenue  
Watertown, South Dakota 57201

Bid of: \_\_\_\_\_  
(hereinafter called "Bidder")

The Bidder, in compliance with your Advertisement for Bids for the Complete Construction (general, mechanical and electrical) work for the proposed building renovations, having examined the drawings and specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies, and to construct the project in accordance with the Contract Documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents of which this Bid is a part. Bidder hereby agrees to commence work under this Contract on or before a date to be specified in written "Notice to Proceed" of the Owner, and to fully complete the project at the dates set forth in the Contract Documents.

BIDDER AGREES TO PERFORM THE COMPLETE CONSTRUCTION for the following sum:

For the following Base Bid: \_\_\_\_\_ (\$ \_\_\_\_\_)

### MAJOR SUBCONTRACTORS:

Precast Concrete \_\_\_\_\_

Steel \_\_\_\_\_

Fire Protection \_\_\_\_\_

HVAC \_\_\_\_\_

Plumbing \_\_\_\_\_

Electrical \_\_\_\_\_

### ADDENDA:

The undersigned acknowledge receipt of addenda as noted and the bid submitted herewith is in accordance with the stipulations set forth herein.

ADDENDUM NO \_\_\_\_\_ DATED \_\_\_\_\_

ADDENDUM NO \_\_\_\_\_ DATED \_\_\_\_\_

ADDENDUM NO \_\_\_\_\_ DATED \_\_\_\_\_

ADDENDUM NO \_\_\_\_\_ DATED \_\_\_\_\_



The undersigned agrees that his bid may not be withdrawn for a period of 30 days from the time set for opening of bids and that if notified of acceptance of his Proposal within the stated time, or at any time thereafter before the bid is withdrawn, he will within ten (10) days of such notification, execute and deliver a Contract in the Form of Contract specified.

The Contractor shall commence work under this Contract within ten (10) calendar days after the date of receipt by him of Notice to Proceed, to prosecute said work diligently, and to complete the entire project ready for use at the dates set forth in the Contract Documents. The time stated for completion shall include a time allowance for inspections, completion of items requiring further attention and a final cleanup of premises.

The above bid includes State and Local Sales Tax on materials and all other State and Federal Taxes that would affect the amount of the bid.

In submitting this bid it is understood that the right is reserved by the Architect and Owners to reject any and all bids and to waive all informalities.

BIDDER: \_\_\_\_\_

BY: \_\_\_\_\_

TITLE: \_\_\_\_\_

BUSINESS  
ADDRESS: \_\_\_\_\_

STATE OF  
INCORPORATION: \_\_\_\_\_  
(SEAL)

# **AIA**® Document A701™ – 2018

## **Instructions to Bidders**

for the following Project:

*(Name, location, and detailed description)*

LATC Diesel Addition & Remodel  
Watertown, South Dakota

### **THE OWNER:**

*(Name, legal status, address, and other information)*

Lake Area Technical College  
1201 Arrow Avenue  
Watertown, South Dakota 57201  
Telephone Number: (605)882-5284

### **THE ARCHITECT:**

*(Name, legal status, address, and other information)*

CO-OP Architecture  
440 East 8<sup>th</sup> Street Suite 221  
Sioux Falls, South Dakota 57103  
Telephone Number: (605)334-9999

### **TABLE OF ARTICLES**

- |          |   |
|----------|---|
| <b>1</b> | <b>DEFINITIONS</b>                                    |
| <b>2</b> | <b>BIDDER'S REPRESENTATIONS</b>                       |
| <b>3</b> | <b>BIDDING DOCUMENTS</b>                              |
| <b>4</b> | <b>BIDDING PROCEDURES</b>                             |
| <b>5</b> | <b>CONSIDERATION OF BIDS</b>                          |
| <b>6</b> | <b>POST-BID INFORMATION</b>                           |
| <b>7</b> | <b>PERFORMANCE BOND AND PAYMENT BOND</b>              |
| <b>8</b> | <b>ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS</b> |

### **ADDITIONS AND DELETIONS:**

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

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

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.

## 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.)*

§ 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.)*

§ 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.

#### § 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten 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.)*

§ 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.)*

§ 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 thirty (30) days after the opening of Bids, withdraw its Bid and request the return of its bid security.

### § 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.)*

See the Supplements to Instruction to Bidders.

§ 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.

### § 4.4 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.

## **§ 5.2 Rejection of Bids**

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

## **§ 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.

## **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.

### **§ 6.2 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 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.)*

## § 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.  
*(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.  
*(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.  
*(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



Title	Date
Diesel Addition & Remodel Construction Documents	11/04/2021

**.6 Specifications**

Title	Date
Diesel Addition & Remodel	11/04/2021

**.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.)*

# Additions and Deletions Report for AIA® Document A701™ – 2018

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 08:35:58 ET on 11/04/2021.

## PAGE 1

LATC Diesel Addition & Remodel  
Watertown, South Dakota

...

Lake Area Technical College  
1201 Arrow Avenue  
Watertown, South Dakota 57201  
Telephone Number: (605)882-5284

...

CO-OP Architecture  
440 East 8<sup>th</sup> Street Suite 221  
Sioux Falls, South Dakota 57103  
Telephone Number: (605)334-9999

## PAGE 5

§ 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 thirty (30) days after the opening of Bids, withdraw its Bid and request the return of its bid security.

...

See the Supplements to Instruction to Bidders.

## PAGE 7

Number	Title	Date
	<u>Title</u>	<u>Date</u>
	<u>Diesel Addition &amp; Remodel Construction Documents</u>	<u>11/04/2021</u>

## PAGE 8

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

<u>Title</u>	<u>Date</u>
<u>Diesel Addition &amp; Remodel</u>	<u>11/04/2021</u>

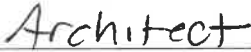
## ***Certification of Document's Authenticity***

**AIA® Document D401™ – 2003**

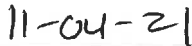
I, Jason Kann, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 08:35:58 ET on 11/04/2021 under Order No. 4747262730 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A701™ – 2018, Instructions to Bidders, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.



(Signed)



(Title)



(Dated)

# **AIA® Document A201® – 2017**

## **General Conditions of the Contract for Construction**

### **for the following PROJECT:**

*(Name and location or address)*

LATC Diesel Addition & Remodel  
Watertown, South Dakota

### **THE OWNER:**

*(Name, legal status and address)*

Lake Area Technical College  
1201 Arrow Avenue  
Watertown, South Dakota 57201

### **THE ARCHITECT:**

*(Name, legal status and address)*

CO-OP Architecture  
440 East 8<sup>th</sup> Street Suite 221  
Sioux Falls, South Dakota 57103

### **TABLE OF ARTICLES**

<b>1</b>	<b>GENERAL PROVISIONS</b>
<b>2</b>	<b>OWNER</b>
<b>3</b>	<b>CONTRACTOR</b>
<b>4</b>	<b>ARCHITECT</b>
<b>5</b>	<b>SUBCONTRACTORS</b>
<b>6</b>	<b>CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS</b>
<b>7</b>	<b>CHANGES IN THE WORK</b>
<b>8</b>	<b>TIME</b>
<b>9</b>	<b>PAYMENTS AND COMPLETION</b>
<b>10</b>	<b>PROTECTION OF PERSONS AND PROPERTY</b>
<b>11</b>	<b>INSURANCE AND BONDS</b>
<b>12</b>	<b>UNCOVERING AND CORRECTION OF WORK</b>
<b>13</b>	<b>MISCELLANEOUS PROVISIONS</b>

### **ADDITIONS AND DELETIONS:**

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

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

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

- 14      TERMINATION OR SUSPENSION OF THE CONTRACT
- 15      CLAIMS AND DISPUTES

Init.

/

## INDEX

(Topics and numbers in bold are Section headings.)

### Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, **12.3**

### Access to Work

**3.16**, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,  
10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

### Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

### Additional Time, Claims for

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

### Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

### Allowances

**3.8**

### Applications for Payment

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

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,  
3.12.10.1, 4.2.7, 9.3.2, 13.4.1

### Arbitration

8.3.1, 15.3.2, **15.4**

## ARCHITECT

**4**

Architect, Definition of

**4.1.1**

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,  
9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,  
13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3,  
4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2,  
9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,  
7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,  
13.4.2, 15.2

Architect's Inspections

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

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,  
3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,  
3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,  
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

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

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

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

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

### Award of Subcontracts and Other Contracts for Portions of the Work

**5.2**

## Basic Definitions

**1.1**

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,  
15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

### Bonds, Performance, and Payment

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

### Building Information Models Use and Reliance

**1.8**

Building Permit

3.7.1

## Capitalization

**1.3**

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

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



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**

### **Uncovering of Work**

**12.1**

### **Unforeseen Conditions, Concealed or Unknown**

3.7.4, 8.3.1, 10.3

### **Unit Prices**

7.3.3.2, 9.1.2

### **Use of Documents**

1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

### **Use of Site**

3.13, 6.1.1, 6.2.1

### **Values, Schedule of**

9.2, 9.3.1

### **Waiver of Claims by the Architect**

13.3.2

### **Waiver of Claims by the Contractor**

9.10.5, 13.3.2, 15.1.7

### **Waiver of Claims by the Owner**

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

### **Waiver of Consequential Damages**

14.2.4, 15.1.7

### **Waiver of Liens**

9.3, 9.10.2, 9.10.4

### **Waivers of Subrogation**

6.1.1, 11.3

### **Warranty**

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

### **Weather Delays**

8.3, 15.1.6.2

### **Work, Definition of**

**1.1.3**

### **Written Consent**

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

### **Written Interpretations**

4.2.11, 4.2.12

### **Written Orders**

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



## **ARTICLE 1 GENERAL PROVISIONS**

### **§ 1.1 Basic Definitions**

#### **§ 1.1.1 The Contract Documents**

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

#### **§ 1.1.2 The Contract**

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

#### **§ 1.1.3 The Work**

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

#### **§ 1.1.4 The Project**

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

#### **§ 1.1.5 The Drawings**

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

#### **§ 1.1.6 The Specifications**

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

#### **§ 1.1.7 Instruments of Service**

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

#### **§ 1.1.8 Initial Decision Maker**

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

### **§ 1.2 Correlation and Intent of the Contract Documents**

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

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

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

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

### **§ 1.3 Capitalization**

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

### **§ 1.4 Interpretation**

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

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

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

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

### **§ 1.6 Notice**

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

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

### **§ 1.7 Digital Data Use and Transmission**

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

### **§ 1.8 Building Information Models Use and Reliance**

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

## **ARTICLE 2 OWNER**

### **§ 2.1 General**

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

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

### **§ 2.2 Evidence of the Owner's Financial Arrangements**

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

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

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

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

### **§ 2.3 Information and Services Required of the Owner**

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

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



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

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

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

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

#### **§ 2.4 Owner's Right to Stop the Work**

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

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

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

### **ARTICLE 3 CONTRACTOR**

#### **§ 3.1 General**

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

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

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

#### **§ 3.2 Review of Contract Documents and Field Conditions by Contractor**

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

**§ 3.2.2** Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

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

### **§ 3.3 Supervision and Construction Procedures**

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

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

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

### **§ 3.4 Labor and Materials**

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

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

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

### § 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

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

### § 3.6 Taxes

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

### § 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

### § 3.7.4 Concealed or Unknown Conditions

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

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



### **§ 3.8 Allowances**

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

**§ 3.8.2** Unless otherwise provided in the Contract Documents,

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

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

### **§ 3.9 Superintendent**

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

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

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

### **§ 3.10 Contractor's Construction and Submittal Schedules**

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

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

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

### **§ 3.11 Documents and Samples at the Site**

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

delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

**§ 3.12 Shop Drawings, Product Data and Samples**

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

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

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

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

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

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

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

**§ 3.12.10.1** If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

**§ 3.12.10.2** If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

### **§ 3.13 Use of Site**

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

### **§ 3.14 Cutting and Patching**

**§ 3.14.1** The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

**§ 3.14.2** The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

### **§ 3.15 Cleaning Up**

**§ 3.15.1** The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

**§ 3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

### **§ 3.16 Access to Work**

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

### **§ 3.17 Royalties, Patents and Copyrights**

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.



### **§ 3.18 Indemnification**

**§ 3.18.1** To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

**§ 3.18.2** In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

## **ARTICLE 4 ARCHITECT**

### **§ 4.1 General**

**§ 4.1.1** The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

**§ 4.1.2** Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

### **§ 4.2 Administration of the Contract**

**§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

**§ 4.2.3** On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

### **§ 4.2.4 Communications**

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.



## ARTICLE 5 SUBCONTRACTORS

### § 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

### § 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

### § 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

### § 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

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

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

### **§ 6.2 Mutual Responsibility**

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### § 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

### § 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### § 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:



- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### § 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

### ARTICLE 8 TIME

#### § 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

## § 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

## § 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

### § 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

### § 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

#### § 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

#### § 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;



- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

## § 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

## **§ 9.7 Failure of Payment**

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

## **§ 9.8 Substantial Completion**

**§ 9.8.1** Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

**§ 9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

**§ 9.8.3** Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

**§ 9.8.4** When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

**§ 9.8.5** The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

## **§ 9.9 Partial Occupancy or Use**

**§ 9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

**§ 9.9.2** Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.



§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

#### § 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

### ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

#### § 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

#### § 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

Init.

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

#### § 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

#### § 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

**§ 10.3.3** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

**§ 10.3.4** The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

**§ 10.3.5** The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

**§ 10.3.6** If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

#### **§ 10.4 Emergencies**

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

### **ARTICLE 11 INSURANCE AND BONDS**

#### **§ 11.1 Contractor's Insurance and Bonds**

**§ 11.1.1** The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

**§ 11.1.2** The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

**§ 11.1.3** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

**§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an



or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

## **§ 11.2 Owner's Insurance**

**§ 11.2.1** The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

**§ 11.2.2 Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

**§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance.** Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

## **§ 11.3 Waivers of Subrogation**

**§ 11.3.1** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

**§ 11.3.2** If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

## **§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance**

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

#### **§11.5 Adjustment and Settlement of Insured Loss**

**§ 11.5.1** A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

**§ 11.5.2** Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

### **ARTICLE 12 UNCOVERING AND CORRECTION OF WORK**

#### **§ 12.1 Uncovering of Work**

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

#### **§ 12.2 Correction of Work**

##### **§ 12.2.1 Before Substantial Completion**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

##### **§ 12.2.2 After Substantial Completion**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### § 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### § 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

### § 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

### § 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and



approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

#### § 13.5 Interest

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

### ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

#### § 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

## § 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

## § 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

## § 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.



§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

## **ARTICLE 15 CLAIMS AND DISPUTES**

### **§ 15.1 Claims**

#### **§ 15.1.1 Definition**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

#### **§ 15.1.2 Time Limits on Claims**

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

#### **§ 15.1.3 Notice of Claims**

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

#### **§ 15.1.4 Continuing Contract Performance**

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

#### **§ 15.1.5 Claims for Additional Cost**

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### **§ 15.1.6 Claims for Additional Time**

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

### § 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

### § 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

### § 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

### § 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

**§ 15.4.4 Consolidation or Joinder**

**§ 15.4.4.1** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

**§ 15.4.4.2** Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

**§ 15.4.4.3** The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.



# **Additions and Deletions Report for**

## **AIA® Document A201® – 2017**

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 08:17:31 ET on 11/04/2021.

### **PAGE 1**

LATC Diesel Addition & Remodel  
Watertown, South Dakota

...

Lake Area Technical College  
1201 Arrow Avenue  
Watertown, South Dakota 57201

...

CO-OP Architecture  
440 East 8<sup>th</sup> Street Suite 221  
Sioux Falls, South Dakota 57103

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

**AIA® Document D401™ – 2003**

I, Jason Kann, hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 08:17:31 ET on 11/04/2021 under Order No. 4747262730 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, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

  
(Signed)

  
(Title)

  
(Dated)

### **Supplements to Instructions to Bidders**

AIA Document A-701 "Instructions to Bidders" latest Edition shall pertain to this contract. The following information and supplements shall modify, change, delete or add to this document. Where any part of the Instructions to Bidders is modified or voided by the following articles, the unaltered provisions of that part shall remain in effect.

3.1.1 Copies of the Plans and Specifications will be made available electronically (pdf format). Technical questions shall be directed to CO-OP Architecture, LLC, Sioux Falls, South Dakota at [jason@co-oparch.com](mailto:jason@co-oparch.com) or 605-334-9999.

4.2.1 Bid Security will be required on this project as specified in Advertisement for Bids.

4.3.1. Bids shall be submitted in sealed envelope plainly marked on face as follows:

Bidders Name

Bidders Address

Proposal For: Diesel Addition & Remodel

Project: Lake Area Technical College

Location: Watertown, South Dakota

4.3.2. Bids will be received as follows:

Date: **December 2, 2021**

Time: **2:00 p.m.**

Location:

**Lake Area Technical College Administrative Offices**

**1201 Arrow Avenue**

**Watertown, South Dakota**

4.4.1. Bids may not be modified, withdrawn or cancelled for thirty (30) days following date for receipt of bids.

5.1. Bids will be publicly opened and read aloud.

6.1. Contractors Qualification Statement, AIA Document A305 will not be required prior to bidding but may be required prior to award of contract. If same is requested, it shall be submitted within ten days from date of request.



- 6.3.1. Forms for submittals of items 6.3.1.1., 6.3.1.2. and 6.3.1.3 will be supplied by the Construction Manager. Forms to be submitted via PDF.
- 7.1.1. Performance Bond and Payment Bond may be required of successful bid package contractor and cost of same to be added as a change order to the contract with a receipt from the bonding company no overhead and profit will be allowed. Bond shall be executed on AIA Standard Form A312, with amount shown on each part equal to 100 percent of the total amount payable by terms of the contract. Surety shall be company licensed to do business in South Dakota and acceptable to architect and owner. Two copies of each are required. Bonds to be issued to owner, same as Bid Security listed in Advertisement for Bids.
- 8.1. A copy of this agreement may be examined by bidders at the office of the architect.

## **EXAMINATION OF BIDDING DOCUMENTS**

Plans and Specifications will be on file at the following places:

- 1. Office of the Architect, Sioux Falls SD
- 2. Building Exchanges in the following Cities

Aberdeen Builders Exchange, Aberdeen, South Dakota

Fargo Builders Exchange, Fargo, North Dakota

Minnesota Builders Exchange, Minneapolis, Minnesota

Plains Builders Exchange, Sioux Falls, South Dakota

Sioux Falls Builders Exchange, Sioux Falls, South Dakota

## **SUPPLEMENTS TO GENERAL CONDITIONS**

AIA Document A-201-2017 "General Conditions of the Contract for Construction", shall pertain to this contract. The following information and supplements shall modify, change, delete or add to this document. Where any part of the General Conditions is modified or voided by the following articles, the unaltered provisions of that part shall remain in effect.

### **Article 3 – Contractor:**

Add the following:

#### **3.7.1.1**

3.10.4 Phasing Schedule is included in the bidding documents

3.12.5.1 Procedures for shop drawing submittals will be as follows:

1. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
2. Submittal Service: Submittal Exchange (1-800-714-0024) [www.submittalexchange.com](http://www.submittalexchange.com)
3. This Service is to be paid for by the General Contractor.

3.12.9.1 Each room, door, window and other items having numbers on the contract drawings shall be referred to by those numbers only and are not to be changed on shop drawings.

3.15.3 During the duration of the project the school will be occupied therefore each contractor is to do a general clean-up at the end of each working day.

### **Article 7 – Changes in the Work**

Add the following:

7.2.1.4. Change orders will be prepared in four copies. Likewise, change order proposals shall be prepared in four copies, or one in pdf form, and shall contain a complete breakdown of all costs and substantiating proposals from subcontractors if involved, shall be attached, Subcontractor proposals also to contain a complete breakdown.

7.2.1.5. Maximum allowance for overhead and profit on add or deduct change orders shall be 5% for overhead and 5% for profit. The cost of the Bond, Builders Risk, basic

construction plant, home office, general superintendent, and the like, shall be considered part of the overhead cost.

#### Article 9 – Progress Payments:

##### 9.6.1. Add the following:

Progress payment retainage: The contract shall be so conditioned that it will provide for retention of not less than the following percentages:

10% of the amount of the contract until the contract is 50% completed at which time the retainage will be reduced to 5% until completed to the satisfaction and acceptance of the architect/owner.

##### 9.10.2. The requirements of this paragraph must be met prior to issuance of final certificate for payment. The contractor will submit AIA Documents G706, G706A, and G707 to architect to meet compliance.

#### Article 10 – Protection of Persons and Property:

##### Add the following:

10.2.7. All parts of the work shall be braced to resist wind or other loads. The contractor shall perform the work with the explicit understanding that the design of the project is based on all parts of the work having been completed and as such, the methods of performance of each part of the work shall be done accordingly.

##### 10.2.8. Temporary items such as, but not limited to:

Scaffolding, staging, lifting, and hoisting devices, shoring, excavation, barricades, and safety and construction procedures necessary in completion of the project shall be the responsibility of the contractors and their subcontractors and shall comply with the applicable codes and regulations. OSHA Standards for the Construction Industry (29CFR Part 1926) shall be complied with in every respect. It shall not be the responsibility of the owner or the architect to determine if the contractors, subcontractors, their representatives are in compliance with the aforementioned regulations.

10.3.7 In Accordance with the provision of state Law SDCL 34-44-8, all Bidders and Contractors are hereby notified that this project does have existing asbestos material. The owner will be paying for the removal of the existing materials prior to work being done.

## Article 11 – Insurance and Bonds

### 11.1 Contractor's Insurance and Bonds

Add the following clauses to 11.1.1:

- 11.1.1.1 The Insurer shall have an A.M. Best rating of "A" or better.
- 11.1.1.2 Liability Insurance shall include all major division of coverage and be on comprehensive basis including:
  - 1. Premises Operations (including X, C and U coverages as applicable).
  - 2. Independent Contractor's Protective.
  - 3. Personal Injury Liability with Employment Exclusion deleted.
  - 4. Contractual, including specified provision for Contractor's obligation under Paragraph 3.18.
  - 5. Broad Form Property Damage including Completed Operations.
- 11.1.1.3 If the General Liability coverages are provided by a Commercial General Liability Policy on a claims-made basis, the policy date or Retroactive Date shall predate the Contract; the termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverages required to be maintained after final payment, certified in accordance with Subparagraph 9.10.2.
- 11.1.1.4 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following limits, or greater if required by law:
  - 1. Workers Compensation:
    - a. State: South Dakota Statutory
    - b. Applicable Federal (e.g. Longshoremen's): Statutory
    - c. Employer's Liability:
      - \$100,000 per Accident
      - \$500,000 Disease, Policy Limit
      - \$100,000 Disease, Each Employee
  - 2. Commercial General Liability (including Premises-Operations; Independent Contractor's Protective; Products and Completed Operations; Broad Form Property Damage Contractual, Personal Injury:

- a. \$1,000,000 Each Occurrence
- b. Owner shall be included as an Additional Insured on the Contractor's General Liability coverage on a Primary Non Contribution basis including completed operations.
- c. General Aggregate; \$2,000,000
- d. Products and Completed Operations to be maintained for two years after final payment.
- e. Property Damage Liability Insurance shall provide X,C, and U coverage. Any exception to the above must be noted on Certificate.
- f. Broad Form Property Damage Coverage shall include Completed Operations.
- g. Personal Injury and Advertising, with Employment Exclusion deleted:  
  
\$1,000,000.
- h. If the General Liability coverages are provided by a Commercial Liability policy, the:

General and Products and Completed Operations aggregate shall not to be less than \$1,000,000 and it shall apply, in total, to this project only. If, under terms of a Commercial General Liability or for products and completed operations aggregate policy or Commercial Umbrella Liability policy or the general aggregate amount specified for this project only, is reduced up to 10% by the total of all claims, paid and pending, for which the Contractor is or may be liable, the Contractor shall notify the Owner within 10 days of such reduction or potential reduction. Contract shall indicate in the notification separate totals for each category, paid and pending. If instructed by the Owner in writing, the Contractor shall, at its own expense, restore the general aggregate to their original amounts. Contractor shall, within 30 days receipt of such notice, submit a revised Certificate of Insurance indicating restoration of required general aggregates. The Contractor may, on its own, restore the general aggregate to the original amounts for this project only at any time during the progress of the work without relying on notification by Owner.

- i. Fire Damage Limit shall be not less than \$50,000 on any one fire.
  - j. Medical Expense Limit shall be not less than \$5,000 on any one person.
3. Business Auto Liability (including owned, non-owned and hired vehicles):

a. Bodily Injury:

\$500,000 Each Person OR for 3a), b) \$1,000,000 CSL  
\$1,000,000 Each Occurrence

b. Property Damage:

\$500,000 Each Occurrence

4. Umbrella Excess Liability:

\$1,000,000 Each Occurrence  
\$1,000,000 General Aggregate  
\$1,000,000 Products & Completed Operations Aggregate  
\$1,000,000 Retention for self-insured hazards each occurrence.





**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**

909 East 50<sup>th</sup> Street North  
Sioux Falls, South Dakota 57104  
Phone 605-335-5512 Fax 605-335-0773

July 2, 2021

Lake Area Technical College  
1201 Arrow Avenue NE  
Watertown, South Dakota 57201

Attn: Shane Ortmeier

Subj: Geotechnical Exploration  
Proposed Archway and Diesel Additions  
Lake Area Technical College  
1201 Arrow Avenue NE  
Watertown, South Dakota  
GeoTek #21-831

This correspondence presents our written report of the geotechnical exploration program for the referenced project. Our work was performed in accordance with your authorization. We are transmitting an electronic copy of our report for your use. Additional copies of our report are also being sent as noted below.

We thank you for the opportunity of providing our services on this project and look forward to continued participation during the design and construction phases. If you have any questions regarding this report, please contact our office at (605) 335-5512.

Respectfully Submitted,  
GeoTek Engineering & Testing Services, Inc.

*Daniel R Hanson*

Daniel R Hanson, PE  
Senior Project Engineer

Cc: CO-OP Architecture, Attn: Jason Kann  
Heyer Engineering, Attn: Britt Haroldson, PE

## **TABLE OF CONTENTS**

<b>INTRODUCTION.....</b>	<b>4</b>
PROJECT INFORMATION .....	4
SCOPE OF SERVICES .....	4
<b>SITE &amp; SUBSURFACE CONDITIONS.....</b>	<b>5</b>
SITE LOCATION & DESCRIPTION .....	5
TEST BORING LOCATIONS & GROUND SURFACE ELEVATIONS .....	5
SUBSURFACE CONDITIONS .....	5
WATER LEVELS .....	6
<b>ENGINEERING REVIEW &amp; RECOMMENDATIONS.....</b>	<b>7</b>
PROJECT DESIGN DATA .....	7
DISCUSSION .....	8
SITE PREPARATION – FOOTING AREAS.....	8
SITE PREPARATION – FLOOR SLAB AREAS.....	9
FOUNDATION LOADS & SETTLEMENT .....	9
EXCAVATION, TEMPORARY SHORING & HELICAL PIERS .....	10
GROUNDWATER & SATURATED SOILS .....	10
LATERALLY OVERSIZED EXCAVATIONS .....	10
FLOOR SLABS & SOIL MODULUS OF SUBGRADE REACTION.....	11
RETAINING WALLS .....	11
COEFFICIENT OF FRICTION .....	12
PERIMETER DRAIN TILE RECOMMENDATIONS .....	12
SEISMIC SITE CLASSIFICATION.....	12
FROST PROTECTION – FOOTINGS .....	12
FROST PROTECTION – SURFACE IMPROVEMENTS.....	12
MATERIAL TYPES & COMPACTION LEVELS .....	13
DRAINAGE .....	15
<b>CONSTRUCTION CONSIDERATIONS .....</b>	<b>15</b>
GROUNDWATER & SURFACE WATER.....	15
DISTURBANCE OF SOILS .....	15
COLD WEATHER PRECAUTIONS .....	15
EXCAVATION SIDESLOPES .....	16
OBSERVATIONS & TESTING .....	16
EXCAVATION .....	17
TESTING.....	17
<b>SUBSURFACE EXPLORATION PROCEDURES .....</b>	<b>17</b>
TEST BORINGS .....	17
SOIL CLASSIFICATION .....	18
WATER LEVEL MEASUREMENTS.....	18
LABORATORY TESTS.....	19

<b>LIMITATIONS .....</b>	<b>19</b>
--------------------------	-----------

<b>STANDARD OF CARE .....</b>	<b>20</b>
-------------------------------	-----------

<b>APPENDIX A</b>	FIGURE 1 – SITE MAP
	BORING LOGS
	SOILS CLASSIFICATION
	SYMBOLS & DESCRIPTIVE TERMINOLOGY

**GEOTECHNICAL EXPLORATION  
PROPOSED ARCHWAY AND DIESEL ADDITIONS  
LAKE AREA TECHNICAL COLLEGE  
1201 ARROW AVENUE NE  
WATERTOWN, SOUTH DAKOTA  
GEOTEK #21-831**

**INTRODUCTION**

**Project Information**

This report presents the results of the recent geotechnical exploration program for the proposed archway and diesel additions for Lake Area Technical College at 1201 Arrow Avenue NE in Watertown, South Dakota.

**Scope of Services**

Our work was performed in accordance with the authorization of Shane Ortmeier with Lake Area Technical College. The scope of work as presented in this report is limited to the following:

1. To perform 12 standard penetration test (SPT) borings to gather data on the subsurface conditions within the footprint of the proposed building addition.
2. To perform laboratory tests that include moisture content, dry density, Atterberg limits (liquid and plastic limits) and unconfined compressive strength.
3. To prepare an engineering report that includes the results of the field and laboratory tests as well as our earthwork and foundation recommendations for design and construction.

The scope of our work was intended for geotechnical purposes only. This scope of work did not include determining the presence or extent of environmental contamination at the site or to characterize the site relative to wetlands status.

## **SITE & SUBSURFACE CONDITIONS**

### **Site Location & Description**

The site is located at 1201 Arrow Avenue NE in Watertown, South Dakota. The current site features within and near the areas proposed building additions include the following: the existing building, a parking lots, sidewalks, Arrow Avenue right-of-way and landscape areas.

The archway addition will be located on the east side of the existing 300 building, extend south over the Arrow Avenue right-of-way and connect to the 800 building. The main diesel addition will be located on the east side of building 900 and a small addition is planed to the south side of building 900.

### **Test Boring Locations & Ground Surface Elevations**

The 12 test borings were performed at the site on June 10 and 14, 2021. Figure 1 is attached showing the relative location of the test borings.

The ground surface elevations at the test boring locations were determined by using the finished floor at a door of the existing building 300 (near boring #1) as a benchmark. An arbitrary elevation of 100.0 feet was used for the benchmark. Based on the benchmark datum, the ground surface elevations at the test boring locations varied from 99.1 feet at test boring 1 to 84.9 feet at test boring 10.

### **Subsurface Conditions**

The subsurface conditions encountered at the test boring locations are illustrated by means of the boring logs included in Appendix A.

The subsurface conditions encountered at the test boring locations for the archway addition (boring #1 to #8) consisted of 1 foot to 7 feet of existing fill materials overlying glacial till soils. The glacial till soils extended to the termination depth of the test borings. The subsurface conditions encountered at the test boring locations for the diesel additions (boring #9 to #12) consisted of 2 feet to 6 feet of existing fill materials and buried topsoil over fine alluvium soils or mixed alluvium



soils. The fine alluvium and mixed alluvium soils extended to depths varying from 5 ½ feet to 8 feet. At this depth, coarse alluvium soils were encountered and extended to the termination depth of the test borings.

The existing fill materials consisted of mostly lean clay (CL). The buried topsoil consisted of lean clay (CL). The fine alluvium soils consisted of lean clay (CL). The mixed alluvium consisted of sandy lean clay (CL). The coarse alluvium soils consisted of sand (SP). The glacial till soils consisted of lean clay with sand (CL).

The consistency or relative density of the soils is indicated by the standard penetration resistance (“N”) values as shown on the boring log. A description of the soil consistency or relative density based on the “N” values can be found on the attached Soil Boring Symbols and Descriptive Terminology data sheet.

We wish to point out that the subsurface conditions at other times and locations at the site may differ from those found at our test boring locations. If different conditions are encountered during construction, then it is important that you contact us so that our recommendations can be reviewed.

### **Water Levels**

Measurements to record the groundwater levels were made at the test boring locations. The time and level of the groundwater readings are recorded on the boring logs. Groundwater was measured in boring 10 at a depth of 15 feet. Groundwater did not enter the other boreholes at the test boring locations at the time of our measurements.

The water levels indicated on the boring logs may or may not be an accurate indication of the depth or lack of subsurface groundwater. The limited length of observation restricts the accuracy of the measurements. Long term groundwater monitoring was not included in our scope of work.

## **ENGINEERING REVIEW & RECOMMENDATIONS**

### **Project Design Data**

We understand that the project will consist of constructing building additions for Lake Area Technical College in Watertown, South Dakota. The building archway addition will consist of a 2 or 3 story Business and General Education Center addition to the east side of building 300, a 1 to 3 story Electronics Systems Technology and Robotics Center addition to the south side of building 800. These 2 additions will be connected by a “archway” over Arrow Avenue. We assume that the finish floors of the additions will match the existing building adjacent floor elevation of 100.0 feet for building 300 and 87.5 feet for building 800. With that said up to 5 feet of fill may be needed in the area of boring 4. We understand that the archway building additions will likely consist of structural steel framing with brick veneer.

The main Diesel Technology addition will be a single-story slab-on-grade structure with a sidewall height of about 20 feet. We assume that the finished floor of the addition will match the finished floor elevation of the existing building of 87.5 feet. With that said up to 4 feet of fill may be needed in the area of boring 10. We understand precast walls with a bar joist roof is planned.

We also assume that foundation support for the building additions will be provided by perimeter footings resting below frost depth and interior footings resting at or slightly below the floor slab. We understand that maximum wall loads for the archway addition will be on the order of 6 kips per lineal foot (klf) and maximum column loads will be on the order of 375 kips. Light floor loads are expected for the archway building additions. We understand that maximum wall loads for the diesel additions will be on the order of 8 kips per lineal foot (klf) and maximum column loads will be on the order of 250 kips. Moderate floor loads are expected for the diesel building additions.

The information/assumptions detailed in the project design data section are important factors in our review and recommendations. If there are any corrections or additions to the information detailed in this section, then it is important that you contact us so that we can review our recommendations with regards to the revised plans.

## **Discussion**

It is our opinion that a spread footing foundation system can be used for support of the proposed building additions after the recommended site preparation has been performed.

In our opinion, the existing fill materials, buried topsoil, fine alluvium soils and mixed alluvium soils are not suitable for support of the footings of the building additions. With that said, we recommend that the footings of the building additions be supported by the glacial till soils or coarse alluvium soils. Regarding the floor slab, it is our opinion that the existing fill materials, buried topsoil, fine alluvium soils and mixed alluvium soils could be used for indirect support of the floor slabs.

## **Site Preparation – Footing Areas**

The site preparation in the footing areas (interior and exterior) of the building additions should consist of removing the existing pavements, existing fill materials, buried topsoil, fine alluvium soils and mixed alluvium soils in order to expose the glacial till soils or coarse alluvium soils. Existing utilities that traverse the addition areas should be removed and rerouted.

**Table 1. Estimated Excavation Depths – Footing Areas (Interior & Exterior)**

<b>Test Boring Number</b>	<b>Ground Surface Elevation, ft</b>	<b>Anticipated Excavation Depth, ft</b>	<b>Approximate Excavation Elevation, ft</b>
1	99.1	1	98.1
2	99.0	7	92.0
3	94.7	1	93.7
4	95.3	4 ½	90.8
5	93.3	3 ½	89.8
6	90.0	2	88.0
7	88.6	1 ½	87.1
8	86.7	4 ½	82.2
9	86.5	8	78.5
10	84.9	5 ½	79.4
11	86.0	7	79.0
12	86.2	8	88.2

If the excavation required to expose the glacial till soils or coarse alluvium soils extends below the bottom-of-footing elevation, then we recommend placing and compacting granular structural fill up to the bottom-of-footing elevation. Please refer to Table 1 for a summary of the anticipated minimum excavation depths to remove the unsuitable soils encountered at the test boring locations. The depth of the excavations will likely vary between the test boring locations.

### **Site Preparation – Floor Slab Areas**

The site preparation in the floor slab areas of the building addition should consist of removing the pavements, vegetation and highly organic soils or excavating to a minimum depth of 12 inches below the bottom-of-floor elevation, whichever is greater. Following the removals, we recommend compacting the exposed subgrade with a large sheepsfoot roller. The vibrator should be turned off next to the existing building to minimize disturbance to the existing building. We also recommend that observations and testing be performed on the materials exposed at the bottom of the excavation. Unstable areas or areas having low density will likely require further excavation. Some unsuitable materials may be encountered adjacent to the existing building (existing exterior foundation wall backfill). Once the subgrade is approved, granular structural fill should be placed and compacted up to the design grade. Based on the existing surface grades, the thickness of the granular structural fill beneath the floor slab will exceed 12 inches in some areas of the building additions. We recommend that the final 6 inches of granular structural fill beneath the floor slab consist of select granular fill.

### **Foundation Loads & Settlement**

If our recommendations are followed during site preparations, then it is our opinion that the footings of the building addition can be sized for a net allowable soil bearing pressure of up to 5,000 pounds per square foot (psf). With the expected loads, net allowable soil bearing pressure and our site preparation recommendations, total settlement of the footings should be less than 1 inch and differential settlement should be less than ½ inch over 50 feet. Unknown soil conditions at the site that are different from those depicted at the test boring locations could increase the amount of expected settlement. At least a portion of the anticipated total settlement may appear as

differential with respect to the existing building. Suitable expansion or control joints should be provided between the existing building and building addition to allow for the expected movement.

### **Excavation, Temporary Shoring & Helical Piers**

All excavations within the footprint of the building addition should be performed with a track backhoe with a smooth edge bucket. The subgrade within the footprint of the building addition should not be exposed to heavy construction traffic from rubber tire vehicles.

If an excavation adjacent to the existing structure is to extend below the existing foundations, then we recommend that the excavation extend 1 foot to 2 feet outside the bottom of the existing foundation and then extend downward and outward at a slope no steeper than 1:1 (horizontal to vertical). This may not apply if caving soils are encountered beneath the existing foundations. In this case, temporary shoring or underpinning may be needed. Helical piers may be needed if an excavation for a footing cannot be safely performed next to the existing structure. Deeper test borings would likely be needed for the design of the helical piers.

We recommend extreme caution be exercised while excavating adjacent to any existing structure to prevent undermining of the existing foundations. The excavations adjacent to any existing structure should be performed in small sections such that only a limited area of the foundation soils supporting the existing structure is exposed for a short period of time.

### **Groundwater & Saturated Soils**

If groundwater or saturated soils are encountered at the bottom of an excavation, then we recommend placing a layer (6 inches to 12 inches) of drainage rock at the bottom of the excavation prior to the placement of the granular structural fill, select granular fill or footings.

### **Laterally Oversized Excavations**

Where granular structural fill or drainage rock is needed below the footings, the bottom of the excavation should be laterally oversized 1 foot beyond the edges of the footings for each vertical foot of granular structural fill or drainage rock required below the footings (1 horizontal : 1 vertical).



### **Floor Slabs & Soil Modulus of Subgrade Reaction**

If our recommendations are followed during site preparations, then it is our opinion that the floor slab of the building addition can be designed using a soil modulus of subgrade reaction (k value) of 100 psi/inch.

### **Retaining Walls**

We recommend backfilling any retaining walls with free-draining sand. The active lateral earth pressures may be employed only if movement of the walls can be tolerated to reach the active state. A horizontal movement of approximately 1/500 of the height of the wall would be required to develop the active state for granular soils. If the above movement cannot be tolerated, then we recommend using the at-rest lateral earth pressures to design the walls. The zone of the sand backfill should extend a minimum of 2 feet outside the bottom of the foundation and then extend upward and outward at a slope no steeper than 1:1 (horizontal to vertical). Also, we recommend capping the sand backfill section with 1 foot to 2 feet of clayey soil in areas that will not have asphalt or concrete surfacing to minimize infiltration of surface waters. Table 2 shows the equivalent fluid unit weight values for the various soil types anticipated for this project.

**Table 2. Equivalent Fluid Unit Weight Values**

Soil Type	At-Rest, pcf		Active, pcf		Passive, pcf	
	Drained	Submerged	Drained	Submerged	Drained	Submerged
Clay	-	-	-	-	220*	115*
Free-Draining Sand (SP)	50	90	35	80	460*	230*

\*Value below frost depth – 0 pcf above frost depth.

The passive resistance in front of a retaining wall should not be used in an analysis unless the wall extends well below the depth of frost penetration due to loss of strength upon thawing. In addition, development of passive lateral earth pressure in the soil in front of a wall requires a relatively large rotation or outward displacement of the wall. Therefore, we do not recommend using passive resistance in front of the wall for the analysis.

During backfill operations, bracing and/or shoring of the walls may be needed. Only hand-operated compaction equipment should be used directly adjacent to the walls.

### **Coefficient of Friction**

It is our opinion that a friction factor of 0.35 can be used between the natural clay soils and the bottom of the concrete. A friction factor of 0.45 can be used between the granular structural fill or drainage rock and the bottom of the concrete. The friction values are considered ultimate values. We recommend applying a theoretical safety factor of at least 2.0.

### **Perimeter Drain Tile Recommendations**

Since the building addition will be slab-on-grade, it is our opinion that drain tile is not needed along the perimeter of the building addition. However, if portions of the building addition are below grade, then drain tile should be installed.

### **Seismic Site Classification**

Based on the test borings and the 2018 International Building Code (IBC), it is our opinion that the site, as a whole, corresponds to a Site Class D (stiff soil). Also, the ground acceleration values are as follows:  $S_s = 0.084$  g,  $S_1 = 0.025$  g,  $S_{MS} = 0.135$  g,  $S_{M1} = 0.060$  g,  $S_{DS} = 0.090$  g,  $S_{D1} = 0.040$  g. Therefore, the seismic design category is "A". The ground acceleration values are based on the ASCE 7-16 (preferred reference standard for 2018 IBC) with Risk Category II/III. If needed, we can provide ground acceleration values for a different design code.

### **Frost Protection – Footings**

We recommend that all footings be placed at a sufficient depth for frost protection. The perimeter footings for heated buildings should be placed such that the bottom of the footing is a minimum of 4 feet below the finished exterior grade. Interior footings in heated buildings can be placed beneath the floor slab. Footings for unheated structures should be placed such that the bottom of the footing is a minimum of 5 feet below the finished exterior grade.

### **Frost Protection – Surface Improvements**

It is our opinion that the on-site clay soils have a moderate frost susceptibility. Surface improvements, such as pavements and sidewalks, constructed on these clay soils are potentially subject to both cosmetic and structural damage caused by frost heaving. We anticipate the heave

for the on-site clay soils to potentially be on the order of 0.1 inch to 0.2 inch for each foot of frost penetration within the soil, which would translate to ½ inch to 1 inch of total movement. The heave could be even greater if free water is available, resulting in a buildup of ice lenses. The surface improvements should be designed to accommodate the potential frost movements, or non-frost susceptible drainage fill should be placed beneath the surface improvements. If movement cannot be tolerated, then we recommend placing non-frost susceptible drainage fill beneath the surface improvements. The non-frost susceptible drainage fill should extend to a depth of 4 feet below the finished exterior grade. If it is desired to reduce (but not eliminate) the amount of potential frost heave, we recommend consideration be given to placing approximately 2 feet of non-frost susceptible drainage fill beneath the surface improvements.

### **Material Types & Compaction Levels**

**Granular Structural Fill** – The granular structural fill should consist of a pit-run or processed sand or gravel having a maximum particle size of 3 inches with less than 15 percent by weight passing the #200 sieve. The granular structural fill should be placed in lifts of up to 1 foot in thickness.

**Select Granular Fill** – The select granular fill should consist of a medium to coarse grained, free-draining sand or rock having a maximum particle size of 1 inch with less than 5 percent by weight passing the #200 sieve. The select granular fill should be placed in lifts of up to 1 foot in thickness.

**Drainage Rock** – The drainage rock should be crushed, washed and meet the gradation specifications shown in Table 3.

**Table 3. Drainage Rock Gradation Specifications**

<b>Sieve Size</b>	<b>Percent Passing</b>
1 ½-inch	100
1-inch	70 – 90
¾-inch	25 – 50
3/8-inch	0 – 5

**Free-Draining Sand** – The free-draining sand should have a maximum particle size of 1 inch with less than 5 percent by weight passing the #200 sieve. The free-draining sand should be placed in lifts of up to 1 foot in thickness.

**Non-Frost Susceptible Drainage Fill** – The non-frost susceptible drainage fill should have a maximum particle size of 1 inch, less than 40 percent by weight passing the #40 sieve and less than 5 percent by weight passing the #200 sieve. The non-frost susceptible drainage fill should be placed in lifts of up to 1 foot in thickness.

**Exterior Foundation Wall Backfill for Slab-on-Grade Structures** – We recommend that either clay or granular soils be used. Debris, organic material or over-sized material should not be used as backfill. If granular soils are used in areas that will not have asphalt or concrete surfacing, then we recommend capping the granular soils with approximately 1 foot of clay soils to minimize infiltration of surface water. The exterior backfill should be placed in lifts of up to 1 foot in thickness. The majority of the on-site soils can be used as backfill.

**Recommended Compaction Levels** – The recommended compaction levels listed in Table 4 are based on a material's maximum dry density value, as determined by a standard Proctor (ASTM: D698) test.

**Table 4. Recommended Compaction Levels**

Placement Location	Compaction Specifications
Below Footings	100%
Below Floor Slabs	95%
Exterior Foundation Wall Backfill for Slab-on-Grade Structures	95%
Behind Retaining Walls	95% - 98%
Non-Structural Areas	90%

Notes: Compaction specifications are not applicable with the drainage rock.

**Recommended Moisture Levels** – The moisture content of the clay backfill materials, when used as backfill around the exterior of a foundation should be maintained within a range of plus 1 percent to minus 4 percent of the materials' optimum moisture content. When the clay backfill materials are used below a vehicle area, or as site grading, the materials' moisture content should

be maintained within a range of minus 1 percent to minus 4 percent of the materials' optimum moisture content. The optimum moisture content should be determined using a standard Proctor (ASTM: D698) test.

The moisture content of the granular backfill materials should be maintained at a level that will be conducive for vibratory compaction.

### **Drainage**

Proper drainage should be maintained during and after construction. The general site grading should direct surface run-off waters away from the excavations. Water which accumulates in the excavations should be removed in a timely manner.

Finished grades around the perimeter of the structure should be sloped such that positive drainage away from the structure is provided. Also, a system to collect and channel roof run-off waters away from the structure is suggested.

## **CONSTRUCTION CONSIDERATIONS**

### **Groundwater & Surface Water**

Water may enter the excavations due to subsurface water, precipitation or surface run off. Any water that accumulates in the bottom of the excavations should be immediately removed and surface drainage away from the excavations should be provided during construction.

### **Disturbance of Soils**

The soils encountered at the test boring locations are susceptible to disturbance and can experience strength loss caused by construction traffic and/or additional moisture. Precautions will be required during earthwork activities in order to reduce the risk of soil disturbance.

### **Cold Weather Precautions**

If site preparation and construction is anticipated during cold weather, we recommend all foundations, slabs and other improvements that may be affected by frost movements be insulated



from frost penetration during freezing temperatures. If filling is performed during freezing temperatures, all frozen soils, snow and ice should be removed from the areas to be filled prior to placing the new fill. The new fill should not be allowed to freeze during transit, placement and compaction. Concrete should not be placed on frozen subgrades. Frost should not be allowed to penetrate below the footings. If floor slab subgrades freeze, we recommend the frozen soils be removed and replaced, or completely thawed, prior to placement of the floor slab. The subgrade soils will likely require reworking and recompacting due to the loss of density caused by the freeze/thaw process.

### **Excavation Sideslopes**

The excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches". This document states that the excavation safety is the responsibility of the contractor. Reference to this OSHA requirement should be included in the project specifications.

### **Observations & Testing**

This report was prepared using a limited amount of information for the project and a number of assumptions were necessary to help us develop our conclusions and recommendations. It is recommended that our firm be retained to review the geotechnical aspects of the final design plans and specifications to check that our recommendations have been properly incorporated into the design documents.

The recommendations submitted in this report have been made based on the subsurface conditions encountered at the test boring locations. It is possible that there are subsurface conditions at the site that are different from those represented by the test borings. As a result, on-site observation during construction is considered integral to the successful implementation of the recommendations. We believe that qualified field personnel need to be on-site at the following times to observe the site conditions and effectiveness of the construction.

### **Excavation**

We recommend that a geotechnical engineer or geotechnical engineering technician working under the direct supervision of a geotechnical engineer observe all excavations for foundations, slabs and pavements. These observations are recommended to determine if the exposed soils are similar to those encountered at the test boring locations, if unsuitable soils have been adequately removed and if the exposed soils are suitable for support of the proposed construction. These observations should be performed prior to placement of fill or foundations.

### **Testing**

After the subgrade is observed by a geotechnical engineer/technician and approved, we recommend a representative number of compaction tests be taken during the placement of the structural fill and backfill placed below foundations, slabs and pavements, beside foundation walls and behind retaining walls. The tests should be performed to determine if the required compaction has been achieved. As a general guideline, we recommend at least one (1) test be taken for every 2,000 square feet of structural fill placed in building and pavement areas, at least one (1) test for every 75 feet to 100 feet in trench fill, and for every 2-foot thickness of fill or backfill placed. The actual number of tests should be left to the discretion of the geotechnical engineer. Samples of proposed fill and backfill materials should be submitted to our laboratory for testing to determine their compliance with our recommendations and project specifications.

## **SUBSURFACE EXPLORATION PROCEDURES**

### **Test Borings**

We performed 12 standard penetration test (SPT) borings on June 10 and 14, 2021 with a truck rig equipped with hollow-stem auger. Soil sampling was performed in accordance with the procedures described in ASTM:D1586. Using this procedure, a 2-inch O.D. split barrel sampler is driven into the soil by a 140-pound weight falling 30 inches. After an initial set of 6 inches, the number of blows required to drive the sampler an additional 12 inches is known as the penetration resistance, or “N” value. The “N” value is an index of the relative density of cohesionless soils and the consistency of cohesive soils. In addition, thin walled tube samples were obtained according to

ASTM:D1587, where indicated by the appropriate symbol on the boring logs. In addition, we also performed one (1) test boring using hand-operated equipment.

The test borings were backfilled with on-site materials and some settlement of these materials can be expected to occur. Final closure of the holes is the responsibility of the client or property owner.

The soil samples collected from the test boring locations will be retained in our office for a period of one (1) month after the date of this report and will then be discarded unless we are notified otherwise.

### **Soil Classification**

As the samples were obtained in the field, they were visually and manually classified by the crew chief according to ASTM:D2488. Representative portions of all samples were then sealed and returned to the laboratory for further examination and for verification of the field classification. In addition, select samples were then submitted to a program of laboratory tests. Where laboratory classification tests (sieve analysis and Atterberg limits) have been performed, classifications according to ASTM:D2487 are possible. Logs of the test borings indicating the depth and identification of the various strata, the “N” value, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the drill holes are also attached in Appendix A. Charts illustrating the soil classification procedures, the descriptive terminology and the symbols used on the boring logs are also attached in Appendix A.

### **Water Level Measurements**

Subsurface groundwater levels should be expected to fluctuate seasonally and yearly from the groundwater readings recorded at the test boring locations. Fluctuations occur due to varying seasonal and yearly rainfall amounts and snowmelt, as well as other factors. It is possible that the subsurface groundwater levels during or after construction could be significantly different than the time the test borings were performed.

### **Laboratory Tests**

Laboratory tests were performed on select samples to aid in determining the index and strength properties of the soils. The index tests consisted of moisture content, dry density and Atterberg limits (liquid and plastic limits). The strength tests consisted of unconfined compressive strength. The laboratory tests were performed in accordance with the appropriate ASTM procedures. The results of the laboratory tests are shown on the boring logs opposite the samples upon which the tests were performed or on the data sheets included in the Appendix.

### **LIMITATIONS**

The recommendations and professional opinions submitted in this report were based upon the data obtained through the sampling and testing program at the test boring locations. We wish to point out that because no exploration program can totally reveal the exact subsurface conditions for the entire site, conditions between test borings and between samples and at other times may differ from those described in our report. Our exploration program identified subsurface conditions only at those points where samples were retrieved or where water was observed. It is not standard engineering practice to continuously retrieve samples for the full depth of the borings. Therefore, strata boundaries and thicknesses must be inferred to some extent. Additionally, some soils layers present in the ground may not be observed between sampling intervals. If the subsurface conditions encountered at the time of construction differ from those represented by our test borings, it is necessary to contact us so that our recommendations can be reviewed. The variations may result in altering our conclusions or recommendations regarding site preparation or construction procedures, thus, potentially affecting construction costs.

This report is for the exclusive use of the addressee and its representatives for use in design of the proposed project described herein and preparation of construction documents. Without written approval, we assume no responsibility to other parties regarding this report. Our conclusions, opinions and recommendations may not be appropriate for other parties or projects.

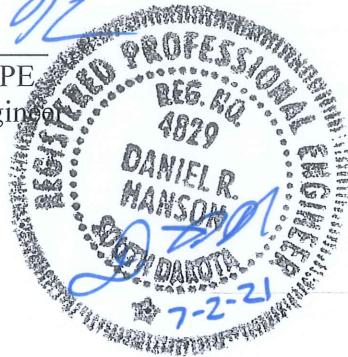
**STANDARD OF CARE**

The recommendations submitted in this report represent our professional opinions. Our services for your project were performed in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering profession currently practicing at this time and area.

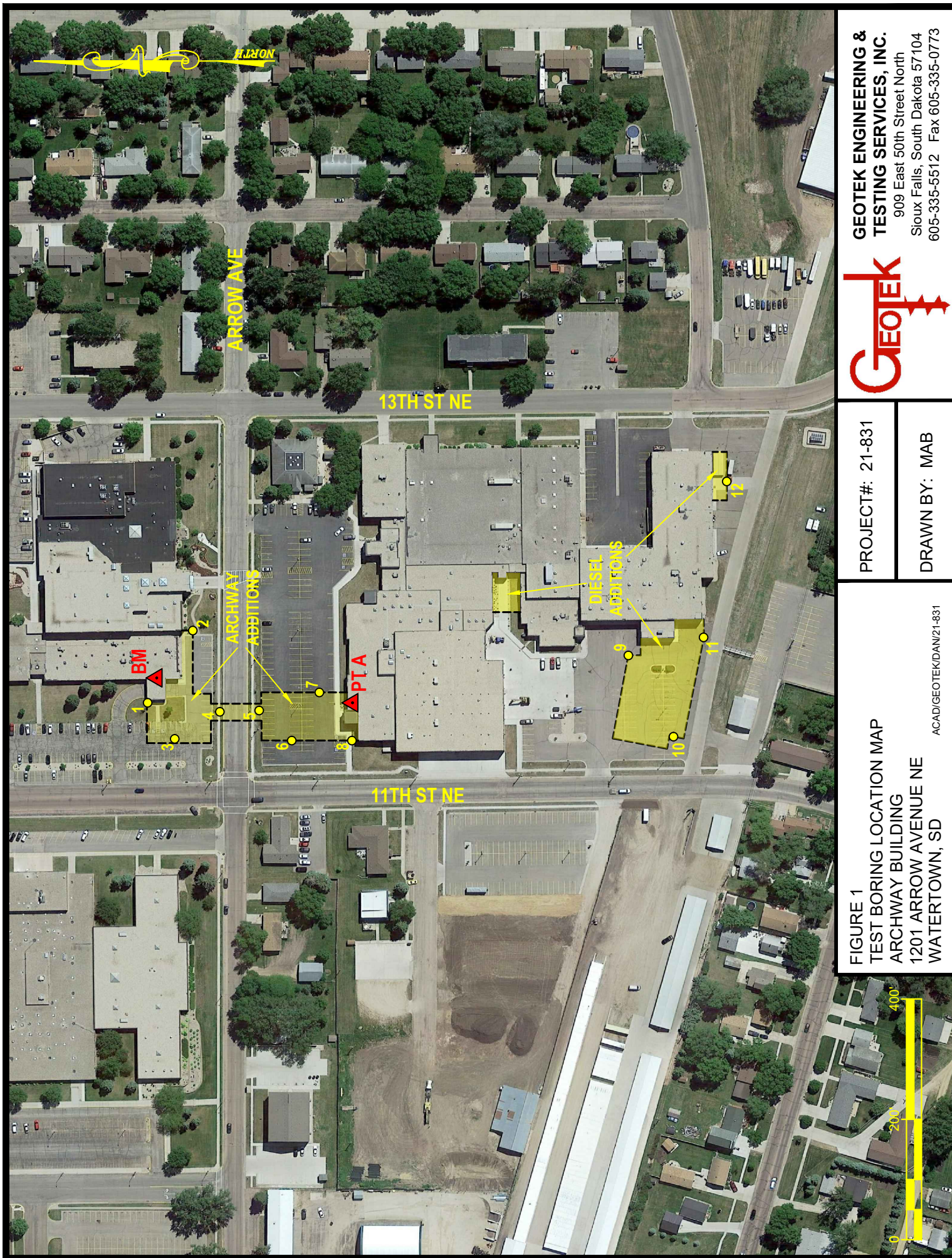
This report was prepared by:  
GeoTek Engineering & Testing Services, Inc.

*[Handwritten signature]*

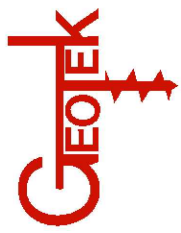
Daniel R Hanson, PE  
Senior Project Engineer







**GEOTEK ENGINEERING & TESTING SERVICES, INC.**  
909 East 50th Street North  
Sioux Falls, South Dakota 57104  
605-335-5512 Fax 605-335-0773



PROJECT#: 21-831
DRAWN BY: MAB

**FIGURE 1**  
**TEST BORING LOCATION MAP**  
**ARCHWAY BUILDING**  
**1201 ARROW AVENUE NE**  
**WATERTOWN, SD**

ACAD/GEOTEK/DAN/21-831





**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # <b>21-831</b>						BORING NO. <b>1 (1 of 1)</b>					
PROJECT <b>Proposed Archway &amp; Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD</b>											
DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION <u>99.1 ft</u>	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
1	<b>FILL, MOSTLY LEAN CLAY:</b> a little gravel, brown, dry to moist	FILL			1	HSA					
	<b>LEAN CLAY WITH SAND:</b> a little gravel, mottled brown and gray, moist, firm to very stiff, (CL)	GLACIAL TILL	8		2	SPT	14				
			12		3	SPT	16	115			4600
			14		4	SPT					
			20		5	SPT					
			19		6	SPT					
			19		7	SPT					
16	Bottom of borehole at 16 feet.										
WATER LEVEL MEASUREMENTS						START <u>6-14-21</u> COMPLETE <u>6-14-21 3:03 pm</u>					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD					
6-14-21	3:05 pm	16	--	14	None	3.25" ID Hollow Stem Auger					
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--	CREW CHIEF Mike Wagner					

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # <b>21-831</b>						BORING NO. <b>2 (1 of 1)</b>					
PROJECT <b>Proposed Archway &amp; Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD</b>											
DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION <u>99.0 ft</u>	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
7	<b>FILL, MOSTLY LEAN CLAY WITH SAND:</b> a little gravel, brown, dry to moist, a few cobbles 2'-3.5'	FILL	OBS		1	HSA					
					2	SPT					
					3	SPT					
					4	SPT					
					5	SPT					
					6	SPT					
					7	SPT					
16	<b>LEAN CLAY WITH SAND:</b> a little gravel, mottled brown and gray, moist, stiff to very stiff, (CL)	GLACIAL TILL	12	16	19	17					
	Bottom of borehole at 16 feet.										
WATER LEVEL MEASUREMENTS						START <u>6-14-21</u> COMPLETE <u>6-14-21 3:48 pm</u>					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD					
6-14-21	3:48 pm	16	--	14	None	3.25" ID Hollow Stem Auger					
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--	CREW CHIEF Mike Wagner					

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG




GEOTEK # <u>21-831</u>						BORING NO. <u>3 (1 of 1)</u>					
PROJECT <u>Proposed Archway &amp; Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD</u>											
DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION <u>94.7 ft</u>	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
1	<b>FILL, MOSTLY LEAN CLAY:</b> a little gravel, brown, dry to moist, 3" of asphalt and 6" of gravel at the surface	FILL			1	HSA					
	<b>LEAN CLAY WITH SAND:</b> a little gravel, mottled brown and gray, moist, firm to very stiff, (CL)	GLACIAL TILL	7		2	SPT	16				
			12		3	SPT					
			14		4	SPT					
			20		5	SPT					
12	<b>LEAN CLAY WITH SAND:</b> a little gravel, brown, moist, very stiff, (CL)	GLACIAL TILL	21		6	SPT					
			23		7	SPT					
16	Bottom of borehole at 16 feet.										
WATER LEVEL MEASUREMENTS						START <u>6-14-21</u> COMPLETE <u>6-14-21 2:18 pm</u>					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD <u>3.25" ID Hollow Stem Auger</u>					
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--	CREW CHIEF <u>Mike Wagner</u>					

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21

GEOTEK # **21-831**

BORING NO. 4 (1 of 1)

**PROJECT** Proposed Archway & Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD

DEPTH in FEET	DESCRIPTION OF MATERIAL		GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS								
						NO.	TYPE	WC	D	LL	PL	QU				
	SURFACE ELEVATION 95.3 ft															
4½	FILL, MOSTLY LEAN CLAY: a little gravel, brown, dry to moist			FILL			1	HSA	21	102						
						2	SPT									
	LEAN CLAY WITH SAND: a little gravel, mottled brown and gray, moist, firm to stiff, (CL)			GLACIAL TILL			3	SPT						16	116	4200
						4	SPT	16						118	7000	
9½	LEAN CLAY WITH SAND: a little gravel, brown, moist, stiff to very stiff, (CL)			GLACIAL TILL		5	SPT									
					6	SPT										
					7	SPT										
					8	SPT										
21	Bottom of borehole at 21 feet.															
WATER LEVEL MEASUREMENTS						START 6-14-21 COMPLETE 6-14-21 1:32 pm										
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD 3.25" ID Hollow Stem Auger										
6-14-21	1:32 pm	21	--	19	None											
--	--	--	--	--	--											
--	--	--	--	--	--											
--	--	--	--	--	--	CREW CHIEF Mike Wagner										



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # **21-831**

BORING NO. **5 (1 of 1)**

PROJECT **Proposed Archway & Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION    93.3 ft	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
2½  3½    6   <											

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21













**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # **21-831**

BORING NO. **6 (1 of 1)**

PROJECT **Proposed Archway & Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION    90.0 ft				GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS					
								NO.	TYPE	WC	D	LL	PL	QU	
2	<b>FILL, MOSTLY LEAN CLAY:</b> a little gravel, brown, dry to moist, 4" of asphalt and 3" of gravel at the surface					FILL			1	 HSA					
	<b>LEAN CLAY WITH SAND:</b> a little gravel, mottled brown and gray, moist, firm to very stiff, (CL)					GLACIAL TILL	6		2	 SPT	19				
							11		3	 SPT	16	115			
							19		4	 SPT					
							18		5	 SPT					
							19		6	 SPT					
							20		7	 SPT					
16	Bottom of borehole at 16 feet.														
WATER LEVEL MEASUREMENTS						START    6-14-21    COMPLETE    6-14-21 10:54 am									
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD 3.25" ID Hollow Stem Auger									
6-14-21	10:54 am	16	--	14	None										
--	--	--	--	--	--										
--	--	--	--	--	--										
--	--	--	--	--	--	CREW CHIEF    Mike Wagner									

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # <b>21-831</b>						BORING NO. <b>7 (1 of 1)</b>					
PROJECT <b>Proposed Archway &amp; Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD</b>											
DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION <u>88.6 ft</u>	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
1½	<b>FILL, MOSTLY LEAN CLAY:</b> a little gravel, brown, dry to moist, 4" of asphalt and 3" of gravel at the surface	FILL			1	HSA					
	<b>LEAN CLAY WITH SAND:</b> a little gravel, mottled brown and gray, moist, firm to very stiff, (CL)	GLACIAL TILL	8		2	SPT	13				
			14		3	SPT	17	112			4200
			17		4	SPT					
9½	<b>LEAN CLAY WITH SAND:</b> a little gravel, brown, moist, very stiff, (CL)	GLACIAL TILL	20		5	SPT					
			21		6	SPT					
			23		7	SPT					
16	Bottom of borehole at 16 feet.										
WATER LEVEL MEASUREMENTS						START <u>6-14-21</u> COMPLETE <u>6-14-21 11:41 am</u>					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD					
6-14-21	11:39 am	16	--	14	None	3.25" ID Hollow Stem Auger					
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--	CREW CHIEF Mike Wagner					

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # **21-831**

BORING NO. **8 (1 of 1)**

PROJECT **Proposed Archway & Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD**

DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION    86.7 ft	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
4½  											

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # <u>21-831</u>						BORING NO. <u>9 (1 of 1)</u>					
PROJECT <u>Proposed Archway &amp; Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD</u>											
DEPTH in FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
	↓ SURFACE ELEVATION <u>86.5 ft</u>										
	<b>FILL, MOSTLY LEAN CLAY:</b> a little gravel, very dark brown, moist, 4" of asphalt and 5" of gravel at the surface	FILL			1	HSA					
4 1/2			12		2	SPT	20	107			
6	<b>LEAN CLAY:</b> very dark brown, moist, firm, (CL)	TOPSOIL	8		3	SPT	25				
	<b>SANDY LEAN CLAY:</b> brown, moist, stiff, (CL)	MIXED ALLUVIUM									
8			16		4	SPT					
	<b>SAND:</b> a little gravel, fine to coarse grained, brown, moist, dense to very dense, (SP)	COARSE ALLUVIUM									
			25		5	SPT					
			28		6	SPT					
			32		7	SPT					
16	Bottom of borehole at 16 feet.										
WATER LEVEL MEASUREMENTS						START <u>6-10-21</u> COMPLETE <u>6-10-21 9:53 am</u>					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD					
6-10-21	9:54 am	16	--	14	None	3.25" ID Hollow Stem Auger					
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--	CREW CHIEF Mike Wagner					

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 E 50th St N  
SIOUX FALLS, SD 57104  
(605) 335-5512 Fax (605) 335-0773  
info@geotekeng.com

# GEOTECHNICAL TEST BORING LOG

GEOTEK # <b>21-831</b>						BORING NO. <b>10 (1 of 1)</b>					
PROJECT <b>Proposed Archway &amp; Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD</b>											
DEPTH in FEET	DESCRIPTION OF MATERIAL ↓ SURFACE ELEVATION <u>84.9 ft</u>	GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
					NO.	TYPE	WC	D	LL	PL	QU
2	<b>FILL, MOSTLY LEAN CLAY:</b> a little gravel, very dark brown, moist, 4" of asphalt and 6" of gravel at the surface	FILL			1	HSA					
4 1/2	<b>LEAN CLAY:</b> very dark brown, moist, firm, (CL)	TOPSOIL	7		2	SPT	33				
5 1/2	<b>LEAN CLAY:</b> brown, moist, firm, (CL)	FINE ALLUVIUM	6		3	SPT	19	106			
	<b>SAND:</b> a little gravel, fine to coarse grained, brown, moist to waterbearing, very dense to loose, (SP)	COARSE ALLUVIUM			4	SPT					
			40		5	SPT					
			25		6	SPT					
			44		7	SPT					
			19	▼	8	SPT					
21	Bottom of borehole at 21 feet.		8								
WATER LEVEL MEASUREMENTS						START <u>6-10-21</u> COMPLETE <u>6-10-21 8:17 am</u>					
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD					
6-10-21	8:14 am	21	--	15	▼ 15.0	3.25" ID Hollow Stem Auger					
--	--	--	--	--	--						
--	--	--	--	--	--						
--	--	--	--	--	--	CREW CHIEF Mike Wagner					

GEOTECHNICAL TEST BORING 21-831.GPJ GEOTEKENG.GDT 6/17/21

GEOTEK # **21-831**

BORING NO. 11 (1 of 1)

**PROJECT** Proposed Archway & Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD

[illegible]



GEOTEK # **21-831**

BORING NO. 12 (1 of 1)

**PROJECT** Proposed Archway & Diesel Additions, Lake Area Technical College, 1201 Arrow Avenue NE, Watertown, SD

DEPTH in FEET	DESCRIPTION OF MATERIAL					GEOLOGIC ORIGIN	N	WL	SAMPLE		LABORATORY TESTS				
									NO.	TYPE	WC	D	LL	PL	QU
	SURFACE ELEVATION 86.1 ft														
	FILL, MOSTLY LEAN CLAY: a little gravel, very dark brown, moist, 5" of asphalt and 22" of gravel at the surface								1	HSA					
4½	LEAN CLAY: very dark brown, moist, stiff, (CL)						11		2	SPT	20	105			
6	LEAN CLAY: brown, moist, stiff, (CL)						9		3	SPT	31				
8							14		4	SPT	22	101			
	SAND: a little gravel, fine to coarse grained, brown, moist, very dense, (SP)						32		5	SPT					
							33		6	SPT					
14½	SAND: a trace of gravel, medium grained, light brown, moist, dense, (SP)						24		7	SPT					
16	Bottom of borehole at 16 feet.														
WATER LEVEL MEASUREMENTS							START 6-10-21 COMPLETE 6-10-21 10:44 am								
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	WATER LEVEL	METHOD									
6-10-21	10:44 am	16	--	14	None	3.25" ID Hollow Stem Auger									
--	--	--	--	--	--										
--	--	--	--	--	--										
--	--	--	--	--	--	CREW CHIEF Mike Wagner									

# BORING LOG SYMBOLS AND DESCRIPTIVE TERMINOLOGY

## SYMBOLS FOR DRILLING AND SAMPLING

<u>Symbol</u>	<u>Definition</u>
Bag	Bag sample
CS	Continuous split-spoon sampling
DM	Drilling mud
FA	Flight auger; number indicates outside diameter in inches
HA	Hand auger; number indicates outside diameter in inches
HSA	Hollow stem auger; number indicates inside diameter in inches
LS	Liner sample; number indicates outside diameter of liner sample
N	Standard penetration resistance (N-value) in blows per foot
NMR	No water level measurement recorded, primarily due to presence of drilling fluid
NSR	No sample retrieved; classification is based on action of drilling equipment and/or material noted in drilling fluid or on sampling bit
SH	Shelby tube sample; 3-inch outside diameter
SPT	Standard penetration test (N-value) using standard split-spoon sampler
SS	Split-spoon sample; 2-inch outside diameter unless otherwise noted
WL	Water level directly measured in boring
▼	Water level symbol

## SYMBOLS FOR LABORATORY TESTS

<u>Symbol</u>	<u>Definition</u>
WC	Water content, percent of dry weight; ASTM:D2216
D	Dry density, pounds per cubic foot
LL	Liquid limit; ASTM:D4318
PL	Plastic limit; ASTM:D4318
QU	Unconfined compressive strength, pounds per square foot; ASTM:D2166

## DENSITY/CONSISTENCY TERMINOLOGY

<u>Density</u>		<u>Consistency</u>
<u>Term</u>	<u>N-Value</u>	<u>Term</u>
Very Loose	0-4	Soft
Loose	5-8	Firm
Medium Dense	9-15	Stiff
Dense	16-30	Very Stiff
Very Dense	Over 30	Hard

## PARTICLE SIZES

<u>Term</u>	<u>Particle Size</u>
Boulder	Over 12"
Cobble	3" – 12"
Gravel	#4 – 3"
Coarse Sand	#10 – #4
Medium Sand	#40 – #10
Fine Sand	#200 – #40
Silt and Clay	passes #200 sieve

## DESCRIPTIVE TERMINOLOGY

<u>Term</u>	<u>Definition</u>
Dry	Absence of moisture, powdery
Frozen	Frozen soil
Moist	Damp, below saturation
Waterbearing	Pervious soil below water
Wet	Saturated, above liquid limit
Lamination	Up to ½" thick stratum
Layer	½" to 6" thick stratum
Lens	½" to 6" discontinuous stratum

## GRAVEL PERCENTAGES

<u>Term</u>	<u>Range</u>
A trace of gravel	2-4%
A little gravel	5-15%
With gravel	16-50%

# SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS  MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS  MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS  (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS  MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS  (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES  (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS  MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS  LIQUID LIMIT LESS THAN 50			ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS  LIQUID LIMIT GREATER THAN 50			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS	

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



**GEOTEK ENGINEERING  
& TESTING SERVICES, INC.**  
909 East 50<sup>th</sup> Street North  
Sioux Falls, South Dakota 57104  
605-335-5512 Fax 605-335-0773

October 29, 2021

Lake Area Technical College  
1201 Arrow Avenue NE  
Watertown, South Dakota 57201

Attn: Shane Ortmeier

Subj: Addendum to Geotechnical Exploration  
Proposed Archway and Diesel Additions  
Lake Area Technical College  
1201 Arrow Avenue NE  
Watertown, South Dakota  
GeoTek #21-831

Dear Mr. Ortmeier:

### **Introduction**

This correspondence is the first addendum to our Geotechnical Exploration report (#21-831) dated July 2, 2021 for the referenced project. We were contacted by Helms & Associates regarding our recommendations for pavement subgrade preparation and recommend pavement thicknesses. We understand the grade changes will be minimal.

### **Pavement Areas**

#### **Discussion**

Test borings 9, 10 and 11 were performed in the planned pavement areas (see attached). These test borings encountered existing fill materials and buried topsoil in the upper 4 ½ feet. In general, favorable subgrade conditions were encountered at test borings 9, 10 and 11. The exception would be the topsoil layer encountered below 2 feet at the test boring 10 location.

### **Subgrade Preparation**

We recommend that the subgrade preparation in the new pavement areas consist of removing the existing pavement and the vegetation and highly organic materials in nonpaved area. It may be possible to salvage the existing gravel encountered below the existing pavement for reuse if care is taken to minimize mixing with the underlying clay subgrade soils. Following the removals, the subgrade should be prepared by cutting or placing subgrade fill to the design elevations. If the buried topsoil materials are present within 2 feet of the subgrade it may be necessary to sub cut the area to provide a minimum of 2 feet of subgrade fill compacted to 95% of the material's maximum dry density value, as determined by a standard Proctor (ASTM: D698) test.

The subgrade fill should consist of either a granular or clay material. Debris, organic material, or over-sized material should not be used as subgrade fill. If a granular material is used, then it should consist of a pit-run or processed sand or gravel having a maximum particle size of 3 inches. The granular material can be placed in lifts of up to 1 foot in thickness. If a clay material is selected, then it should consist of a non-organic clay having a liquid limit less than 45. Scrutiny on the clay material's moisture content should be made prior to the acceptance and use. The clay fill should be placed in lifts of up to 6 inches in thickness. The majority of the on-site soils can be used as subgrade fill.

Once the design elevations have been achieved, we recommend that a proof roll be performed on the exposed subgrade with a truck weighing 20 tons to 30 tons. During the proof roll, unstable areas in the subgrade should be delineated from stable areas. An unstable area would be considered a location with at least 1 inch of rutting or deflection. Unstable areas will need additional corrections to provide a uniform and stable subgrade condition. Additional corrections may include the following: moisture conditioning the soils (e.g. drying the soils by scarification), mixing self-cementing Class C flyash or cement with the subgrade soils, an overexcavation to remove and replace the unstable subgrade soils, the placement of a woven geotextile fabric at the subgrade surface, and/or the placement of granular subbase at the subgrade surface. The type of correction performed should be determined after observing the performance of the subgrade during the proof roll test. We expect that stable conditions will be encountered during drier periods of the year,

while some unstable conditions could be encountered during wetter periods of the year. Also, as previously stated additional corrections may be needed in areas where the buried topsoil is within 2 feet of the subgrade elevation.

### **Pavement Section Thicknesses**

Table A shows the recommended pavement section thicknesses based on the subsurface conditions and anticipated traffic loads.

**Table A. Recommended Pavement Section Thicknesses**

<b>Pavement Description</b>	<b>Pavement Surfacing, in</b>	<b>Aggregate Base Course, in</b>
<b>Car Only Areas</b>		
Asphalt:	4	6
PC Concrete:	5	6
<b>Heavy Duty Areas</b>		
Asphalt:	5	9
PC Concrete:	7	6

The aggregate base course materials meet the requirements of Sections 260 and 882 of the SDDOT Standard Specifications. The existing aggregate base course should be tested to see if it meets the SDDOT specification prior to reuse. The aggregate base course should be compacted to 97% of the material's maximum dry density value, as determined by a standard Proctor (ASTM: D698) test.

The asphalt pavement should meet the requirements of sections 320 and 321 for Class G. We recommend the concrete pavement meet the requirements of Section 380 of the SDDOT Standard Specifications.

It should be noted that routine maintenance such as crack filling, localized patching, and seal coating should be expected with all pavements in our recommendations. The design sections could be reduced if the owner is willing to assume additional maintenance costs or potentially shorter pavement life.



### Excavation – Pavement Areas

Conventional scrapers can typically be utilized for soils having low to moderate moisture contents levels; however, if soils with high moisture content levels are encountered, then low-ground pressure construction equipment should be used.

### Standard of Care


The recommendations submitted in this report addendum represent our professional opinions. Our services for your project were performed in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering profession currently practicing at this time and area.

### Remarks

We trust that this addendum addresses your questions. If you have other questions regarding our report and this addendum, please contact our office at (605) 335-5512.

Respectfully Submitted,

GeoTek Engineering & Testing Services, Inc.

  
Daniel Hanson, PE  
Senior Project Engineer



CONFLUENCE

LANDSCAPE ARCHITECT  
CONFLUENCE  
440 E 8TH STREET, SUITE 121  
SIOUX FALLS, SD 57102-338, 1215  
CONTACT: TYLE FIDWALL, ASLA  
EMAIL: tyler@confluence.com

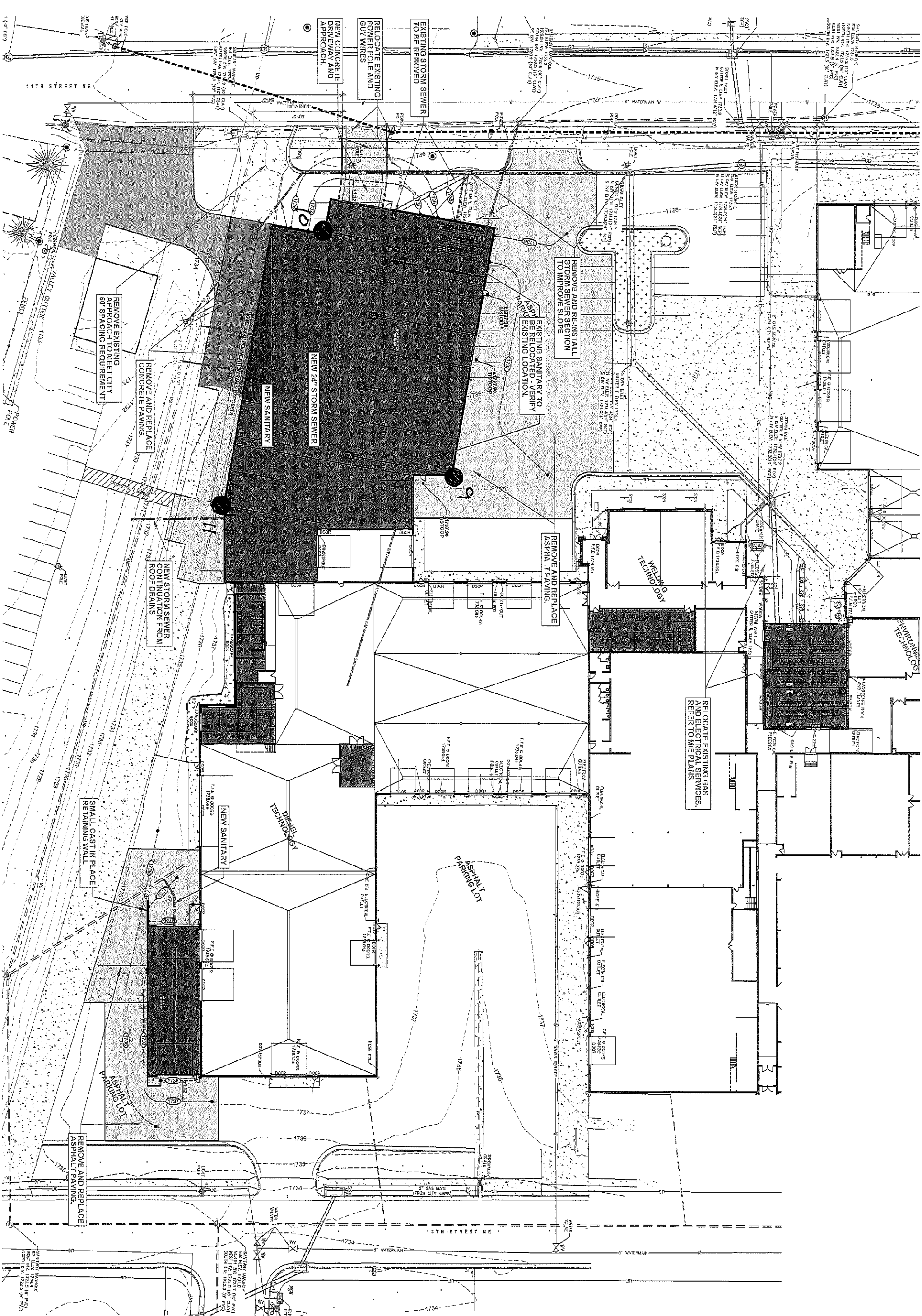
CO-OP PROJECT NO.: 2104

PRELIMINARY  
NOT FOR  
CONSTRUCTION

ISSUE:  
10/06/21

REVISION SCHEDULE:  
REV. # REV. DESC. REV. DATE

PROJECT:  
DIESEL ADDITION & REMODEL  
LATE AREA TECHNICAL COLLEGE  
WATERTOWN, SOUTH DAKOTA



## **SECTION 011000 SUMMARY**

### **PART 1 GENERAL**

#### **1.01 PROJECT**

- A. Project Name: LATC Diesel Addition & Remodel
- B. Owner's Name: Lake Area Technical College.
- C. Architect's Name: CO-OP Architecture.

#### **1.02 DESCRIPTION OF ALTERATIONS WORK**

- A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.
- B. Scope of alterations work is indicated on drawings.
- C. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- D. HVAC: Alter existing system and add new construction, keeping existing in operation.
- E. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
- F. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
- G. Telephone: Alter existing system and add new construction, keeping existing in operation.
- H. Security System: Alter existing system and add new construction, keeping existing in operation.

#### **1.03 OWNER OCCUPANCY**

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

#### **1.04 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Arrange use of site and premises to allow:
  - 1. Work by Others.
  - 2. Work by Owner.
  - 3. Use of site and premises by the public.
  - 4. Maintain secure fence and perimeter.
- C. Provide access to and from site as required by law and by Owner:
  - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Utility Outages and Shutdown:
  - 1. 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.
  - 2. Prevent accidental disruption of utility services to other facilities.

**END OF SECTION**

**SECTION 012000  
PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.

**1.02 SCHEDULE OF VALUES**

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- 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.

**1.03 APPLICATIONS FOR PROGRESS PAYMENTS**

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Forms filled out by hand will not be accepted.
- C. 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.
- D. Execute certification by signature of authorized officer.
- E. Submit three copies of each Application for Payment.

**1.04 MODIFICATION PROCEDURES**

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
  - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 7 days.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
- E. 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.
- F. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

#### **1.05 APPLICATION FOR FINAL PAYMENT**

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
  - 1. All closeout procedures specified in Section 017000.

**END OF SECTION**

**SECTION 012200  
UNIT PRICES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.

**1.02 RELATED REQUIREMENTS**

- A. Section 012000 - 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, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; 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. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Architect in association with Owner's testing agency.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.

**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.
- B. Payment will not be made for any of the following:
  - 1. Products wasted or disposed of in a manner that is not acceptable.
  - 2. Products determined as unacceptable before or after placement.
  - 3. Products not completely unloaded from the transporting vehicle.
  - 4. Products placed beyond the lines and levels of the required Work.
  - 5. Products remaining on hand after completion of the Work.
  - 6. Loading, hauling, and disposing of rejected Products.
  - 7. Any work that is not properly documented at the time of removal or placement

**1.07 SCHEDULE OF UNIT PRICES**

- A. Item A – Over Excavation of Unsuitable Material: \$\_\_\_\_\_per CuYd
- B. Item B – Imported and Compacted Fill: \$\_\_\_\_\_ per CuYd

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**



**SECTION 013000  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Electronic document submittal service.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Submittals for review, information, and project closeout.
- F. Number of copies of submittals.
- G. Submittal procedures.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE**

- A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF) format and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
  - 1. Besides submittals for review, information, and closeout, this procedure applies to requests for information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
  - 2. Contractor and Architect are required to use this service.
  - 3. It is Contractor's responsibility to submit documents in PDF format.
  - 4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
  - 5. Users of the service need an email address, Internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, [www.adobe.com](http://www.adobe.com), or Bluebeam PDF Revu, [www.bluebeam.com](http://www.bluebeam.com)), unless such software capability is provided by the service provider.
  - 6. Paper document transmittals will not be reviewed; emailed PDF documents will not be reviewed.
  - 7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.
- B. Submittal Service: The selected service is:
  - 1. Submittal Exchange (tel: 1-800-714-0024): [www.submittalexchange.com/#sle](http://www.submittalexchange.com/#sle).

**3.02 PRECONSTRUCTION MEETING**

- A. Architect will schedule a meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.
  - 3. Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
  - 5. Designation of personnel representing the parties to Contract and .
  - 6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.

7. Scheduling.
- D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.03 PROGRESS MEETINGS**

- A. Attendance Required:
  1. Contractor.
  2. Owner.
  3. Architect.
  4. Contractor's Superintendent.
  5. Major Subcontractors.
- B. Agenda:
  1. Review minutes of previous meetings.
  2. Review of Work progress.
  3. Field observations, problems, and decisions.
  4. Identification of problems that impede, or will impede, planned progress.
  5. Review of submittals schedule and status of submittals.
  6. Maintenance of progress schedule.
  7. Corrective measures to regain projected schedules.
  8. Planned progress during succeeding work period.
  9. Maintenance of quality and work standards.
  10. Effect of proposed changes on progress schedule and coordination.
  11. Other business relating to Work.
- C. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 013216**

- 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. Submit updated schedule with each Application for Payment.

### **3.05 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  1. Product data.
  2. Shop drawings.
  3. Samples for selection.
  4. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. Samples will be reviewed only for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

### **3.06 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  1. Design data.
  2. Certificates.
  3. Test reports.
  4. Inspection reports.
  5. Manufacturer's instructions.
  6. Manufacturer's field reports.

- 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

### **3.07 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:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.
- D. Submit for Owner's benefit during and after project completion.

### **3.08 NUMBER OF COPIES OF SUBMITTALS**

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
  - 1. After review, produce duplicates.
  - 2. Retained samples will not be returned to Contractor unless specifically so stated.

### **3.09 SUBMITTAL PROCEDURES**

- A. Shop Drawing Procedures:
  - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related Work.
  - 2. Generic, non-project specific information submitted as shop drawings do not meet the requirements for shop drawings.
- B. Transmit each submittal with a copy of approved submittal form.
- C. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.
- D. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- E. 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.
- F. Schedule submittals to expedite the Project, and coordinate submission of related items.
- G. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
- H. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.
- I. Provide space for Contractor and Architect review stamps.
- J. When revised for resubmission, identify all changes made since previous submission.
- K. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- L. Submittals not requested will not be recognized or processed.

**END OF SECTION**

**SECTION 013216  
CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

**1.02 SUBMITTALS**

- A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

**1.03 SCHEDULE FORMAT**

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

**3.02 CONTENT**

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- D. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- E. Indicate delivery dates for owner-furnished products.
- F. Provide legend for symbols and abbreviations used.

**3.03 BAR CHARTS**

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

**3.04 REVIEW AND EVALUATION OF SCHEDULE**

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

**3.05 UPDATING SCHEDULE**

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.

### **3.06 DISTRIBUTION OF SCHEDULE**

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

**END OF SECTION**

**SECTION 014000  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Submittals.
- B. Control of installation.
- C. Testing and inspection agencies and services.
- D. Control of installation.
- E. Defect Assessment.

**1.02 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Test Reports: After each test/inspection, promptly submit two 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. Conformance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.

**1.03 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

**PART 3 EXECUTION**

**2.01 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.

**2.02 TESTING AND INSPECTION**

- A. 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.
- B. Limits on Testing/Inspection Agency Authority:
1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  2. Agency may not approve or accept any portion of the Work.
  3. Agency may not assume any duties of Contractor.
  4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
  5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

### **2.03 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not conforming to specified requirements.

#### **END OF SECTION**

## SECTION 014523

### QUALITY CONTROL – TESTING AND INSPECTING SERVICES

#### PART 1- GENERAL

##### 1.1 WORK INCLUDED

- A. Extent of work of this section includes all labor, materials, equipment and services necessary for the testing of specific contractor installed materials in the Construction Documents.
- B. As the Testing Laboratory is not a Contractor; the normal services and agreements in the general conditions and bidding procedures do not apply. This section, governs the procedures.
  - 1. Testing Laboratory performance is governed by the laws of the **State of South Dakota**.
- C. Selection, payment and use of Testing Laboratory Services
  - 1. By providing a cost for the services described below directly to the owner, on the date of other bids, the Testing Laboratory shall be retained and paid for by the Owner, except as noted. The Testing Laboratory shall act in all matters relating to testing.
    - a. Contractors will not control the means or the methods of testing or inspections. Contractors must however provide scheduling information to the Testing Laboratory.
    - b. Testing agency will contact the Architect and Engineer for instructions on scope of the work, if necessary.
- D. It shall be the responsibility of the Testing Laboratory to familiarize themselves with all sections of the Contract Documents and the project schedule.
- E. All testing required of this project shall be performed by a single testing laboratory.
- F. The testing requirements shall remain in force for the full duration of the construction contract, including all delays or time extensions.
- G. Provide to the Contractor, contact information, list of items to be inspected and other information to assist the Contractor in scheduling his work, while allowing for inspections and tests of this section.
- H. Related Contract Documents.
  - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and remaining Division 00 and 01 Specification Sections as they apply to this section.

##### 1.2 TESTING LABORATORY REQUIREMENTS OF COST AND ABILITY

- A. All testing laboratories desiring to provide their services for this project must submit for approval to the Owner, at the time and date of bid, for review by the Architect the following:
  - 1. Documentation that the Testing Laboratory meets requirements of the American Council of Independent Laboratories (ACIL).
  - 2. Provide documentation that the Testing Laboratory has an in-house quality assurance program.
  - 3. Proof that the Testing Laboratory is owned and directly managed by a Professional Engineer, licensed in the State where testing and inspections occur.
    - a. Principals of the Testing Laboratory and their project managers must be registered professional engineers with a minimum of five years experience in the types of testing required under this contract. Each person in charge of laboratory testing, field-testing and inspection must have not less than one's years experience in the duties performed under this contract and shall perform their duties only under the direct supervision of a registered professional engineer.
  - 4. Total price of services for the project, as a bid, based on the scope of the work shown in this section and the laws of the state of South Dakota as they relate to professional engineering services.
    - a. Use Bid form provided in Project Manual.
    - b. This bid if made into a contract is not subject to retainage.

- c. This bid is a lump sum made on the basis of a computation of unit prices for testing and observation services. At the end of this section a quantity of units in terms of hours and or specific activities is given. The bid provided shall be based on that information.

*\* The Quantity of tests required is part of the submittal by the Testing Laboratory to the Owner. (See end of Part 3)*

- d. Provide a unit price for each hour or quantity asked for. These unit prices shall become the basis, if required, to provide additional testing services.

### **1.3 REFERENCES**

- A. ANSI/ASTM E329 - Standard Practice for Use in the Evaluation of Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- B. ASTM E543 - Practice for Determining the Qualifications of Agencies Performing Nondestructive Testing.
- C. ASTM E548 - Standard Guide for General Criteria Used for Evaluating Laboratory Competence.
- D. ASTM A802 – Standard Practice for examination of steel castings, surface acceptance and visual examination.
- E. ASTM E174 Standard Practice for Radiographic Examination.
- F. ASTM C1077 – Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- G. ASTM C1093 - Practice for the Accreditation of Testing Agencies for Unit Masonry.
- H. ANSI/ASTM D3740 - Standard Recommended Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- I. ASTM D4561 – Practice for quality control systems for an inspection and testing agency for bituminous paving materials.
- J. ASTM E699 – Practice for criteria for evaluation of agencies involved in testing, quality assurance, and evaluating building components in accordance with test methods promulgated by ASTM committee E6.
- L. ICBO Model Program for Special Inspection (excerpts).
- N. CASE-Council of American Structural Engineers.
- O. AIA Document A201 - General Conditions - 1997 Edition

### **1.4 RELATED SECTIONS**

- A. Project specifications and plans for all items to be inspected.
- B. Schedule as shown in Division 01 in Project Specifications.
- C. Submittals section in Division 01 as shown in Project Specifications.
- D. Contract closeout section in Division 01 as shown in Project Specifications.
- E. Project meeting Section in Division 01 as written in Project Specifications.

### **1.5 REPORTS OF TESTING**

- A. Written Reports: Submit all test reports to Owner, Architect and Engineer, within 72 hours after each test is completed. Contractor shall also be given a copy.
- B. Verbal Phone Reports: Testing Laboratory is to give immediate verbal notification, to the Owner, the Architect, and to Heyer Engineering, immediately of any irregularity, failure, or non-compliance of tested items to ensure all necessary retesting and/or replacement of materials with the least possible delay in progress of the work.
- C. Test Standards: Testing Laboratory shall furnish the Architect and Engineer upon request, one (1) copy of each standard (ASTM, AASHTO and AWS) referred to or which is pertinent to these specifications.
- D. All reports, written and verbal, must state clearly whether work inspected or tested is/is not in compliance with Contract Documents.

## 1.6 PAYMENT OF TESTING SERVICES

### A. Initial services:

1. The Owner, will pay for all initial-testing services requested by and anticipated by this specification. Costs for all such testing services shall be included in a proposal submitted directly to the Owner through the Architect. See information in this section.
  - a. See form at end of this specification section 3 for the required testing units. These units in either hours or events will form the basis of the cost of testing laboratory services.
2. Owner will through the Architect issue a change order if additional services are required. These additional services must be agreed to in writing by the owner, the testing laboratory and the architect. Additional services will be based on unit prices submitted by the testing laboratory and listed at the end of this specification section.

### B. Additional or re-testing:

1. When initial tests indicate non-compliance with the Contract Documents, all subsequent re-testing occasioned by the non-compliance shall be performed by the same Testing Laboratory and the costs thereof will be borne entirely by the **Contractor**. If needed the Owner, through the Architect, will deduct the amount of the re-testing from the Contractors pay request.

### C. Contractor required specimens and tests not in this Specification Section.

1. Products and materials, such as concrete, masonry, mortar or proposed engineered fill, requiring a test report or a design done by a Professional Registered Engineer prior to use; shall be performed by the Contractor and are not a part of the cost of this section for the Testing Laboratory Services.
2. Mechanical balancing, adjusting, or startup of systems or motor startup by either Mechanical, Electrical, or Plumbing Contractors is not a part of this work.

## 1.7 NON COMPLIANCE WORK STOPPAGE

A. The Testing Laboratory shall act as the Owner's agent in testing and inspections on items in this section to determine compliance with plans and specifications.

B. The Testing Laboratory **shall further advise the Owner, the Architect and the Structural Engineer if the non-compliance should result in the Owner** stopping that type of work from being performed until corrective action or replacement is completed. Based on the following criteria:

1. If additional work would be added to existing non-complying work, adding additional expense to the Contractor to remove.
2. It is clear by the quality and status of the non-complying work that the Contractor will continue to produce substandard work.
3. It is clear that the Contractor does not understand how the work is to be produced in a manner consistent with the Contract Documents.
4. A required inspection by a governmental official cannot be done unless further work is stopped, or work needed to be inspected is in danger of being covered.
5. Public or worker safety in the sole opinion, of the Testing Agency, would be compromised if the work continues.

## 1.8 LIMITS ON AUTHORITY

- A. Employment of the Testing Laboratory in no way relieves the Contractor of his obligation to perform work in accordance with requirements of Contract Documents.
- B. Inspection firm may not release, revoke, alter, or enlarge any requirements of the Contract Documents.
- C. Inspection firm may not approve or accept any portion of the work.
- D. Inspection firm may not assume any duties of the Contractor.
- E. As stated in Section 1.6 above, Owner, not Testing Laboratory, has authority to stop work.

- F. Mechanical balancing, adjusting or startup of systems or motor startup by either Mechanical, Electrical or Plumbing Contractors is not a part of this work.

## **1.9 CONTRACTOR SCHEDULING AND NOTIFICATION RESPONSIBILITY**

### **A. Even though Contractor is not paying for the work of this section. He must perform the notification and scheduling of all Testing. Therefore Contractor shall:**

1. Provide notification to the Testing Laboratory based on schedule of all work to be inspected. Inspections missed due to the Contractor not notifying Testing Laboratory shall require contractor dismantling and un-covering of in place work.
  - a. If this is not done, the Owner, will stop all construction at the contractor's expense until he receives the proper documentation that the tests were performed. Once the engineer has approved the criteria and testing results, the work may proceed.
2. The Testing Laboratory shall attend the pre-construction meeting and all other meetings during work that is to be inspected to familiarize themselves with the project, the contractors and the project schedule.
  - a. **The Contractor is responsible for the project schedule and for scheduling of all testing.**
3. When changes of construction schedule are necessary during construction, the Contractor shall make contact with the Testing Laboratory to determine such schedule changes.
  - a. The Testing Laboratory will not be held accountable for lack of inspection when a Contractor purposely covers portions of the work to be inspected.
4. Provide incidental labor and materials to provide access to work to be inspected. Such as having ladders, available scaffolding and other components readied and in the same safe condition as that available for they're own workmen.
5. Inspection or testing performed exclusively for a Contractor's convenience shall be the sole responsibility of the Contractor. This includes strength tests for OSHA or AWAIR.

## **1.10 TAKING SPECIMENS**

- A. All specimens and samples for testing will be taken only by the Testing Laboratory; all sampling equipment and personnel will be provided by the Testing Laboratory; and all deliveries of specimens and samples to the Testing Laboratory will be performed only by the Testing Laboratory.
1. The only exception for taking of specimens is that the Masonry Contractor may take his own mortar test cylinders. However they must be transported by the Testing Laboratory.
- B. Contractors shall provide representatives of the Testing Laboratory access to the work at all times in order that the Laboratory may properly perform its functions.

## **1.11 CODE COMPLIANCE TESTING**

- A. Inspections and test required by codes or ordinances, or by a plan approval authority, not listed in Part 3 Execution, shall be the responsibility of and shall be paid for by the Contractor, unless otherwise provided in the Contract Documents.
1. Contractor, not Testing Laboratory, is responsible for design of certain materials to be used in the field such as concrete and mortar mix designs and design of precast, wood and light gauge engineered assemblies and systems.

## **1.12 SPECIAL INSPECTIONS**

- A. All requirements under the Special Inspections portion of the International Building Code are separate items not listed under this section. They however are required by the Owner of the Contractor.

## **PART 2 – PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 VIBRATION CONTROL (Not Used)**

### **3.2 EXCAVATION & BACKFILLING (Includes Special Inspection per CASE and IBC 2018)**

- A. The Testing Laboratory shall be on site to observe and monitor the mass site excavation and backfilling of the building structure area.

1. Verify that all unsuitable organic materials, black and soft soils have been removed.
  2. Test the mass backfill and verify correct depth of material backfill lifts.
  3. After mass backfill is complete, monitor and verify the correction of secondary settlement and inform the Architect/Structural Engineer and General Contractor the readiness for footing excavation to begin.
- B. Inspect each footing and slab subgrade to determine if subgrade materials are acceptable. Perform hand auger borings and soil classifications. Make density tests to determine if the actual soil bearing values capacity complies with specified value.
- C. Test all engineered fill materials as to density and optimum moisture content. Per ASTM D698.
1. Visit the site of the borrow pit or site and determine that anticipated values of sample are consistent with all materials to be used from the pit or site.
  2. Use values determined from tests to calibrate site compaction and soil density work.
- D. For footings or foundation walls. Take soil density and moisture tests at the site in all engineered fill areas. Test 4 corners of each 2000 s. f. or 2 locations in every 100 lineal foot of fill and backfill. This shall be done per every one foot of lift, of fill or backfill. Per Nuclear Density Method B in ASTM D2922 overall Basis.
- G. Slab on grade work includes the use of vapor barrier and a 6" granular cushion. Examine both prior to placement of reinforcing steel to determine that:
1. All mechanical, electrical, underfloor drainage and or other below surface work are complete prior to installation of vapor barrier and or granular cushion. Do not allow placement until underground work is complete.
  2. All vapor barrier seams are overlapped a min. of 12 inches. Sides of vapor barrier are raised up 12" over the top level of slab and are attached to walls and that all seams are taped.
  3. The 6" granular fill is placed above the vapor barrier and the vapor barrier is not broken during placement.

### 3.3 GRADING FOR PARKING LOTS, DRIVEWAYS, APPROACHES

- A. Testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved Concrete or Asphalt Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area, but in no case fewer than three tests.
  2. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### 3.4 ASPHALTIC CONCRETE

- A. Verify at batch plant that asphaltic formulation meets project specifications.
- B. Test aggregate base course for proper compaction and observe proof rolling for pumping.
1. Aggregate base course must be compacted to not less than 100% Standard Proctor maximum dry density ASTM D698.
  2. Areas that are pumping must be cut out, relaid, recompact and proof rolled.
- A. Verify correct number of asphalt lifts are being laid.
- B. Take bituminous course tests at every 5000 sq. feet for bitumen content, gradation of aggregate, field density, air void content and thickness. **(All tests must be taken after laydown but prior to rolling or compaction.)**
1. Test each course.



2. Density must be 95% of Marshall density.
  3. Asphalt content by weight shall be 6.0 to 8.0% of the total mixture.
  4. Air void Content shall be 3-5% maximum as per ASTM 2041.
- C. Using surveying equipment and or lasers verify drainage of all paved areas after compaction and rolling. Drainage in all paved areas to be a minimum of 1/4" per foot.
1. Test at random 10'-0" areas so that surface is smooth to 1/4" +/- in 10'-0" area.
- All bird baths must be redone.

### 3.5 FORMWORK (Includes Special Inspection per CASE and IBC 2018)

- A. Verify formwork for all concrete will result in member size, location, and configuration as described on the contract documents, as it affects the structural integrity of the concrete elements to be placed.
1. Measure distance between forms and reinforcing to determine proper coverage of reinforcing.
  2. Check for form oil or lubricants on reinforcing.
  3. Verify that formwork is properly tied and supported.

### 3.6 REINFORCING STEEL (Includes Special Inspection per CASE and IBC 2018)

- A. All steel bars must be positively identified as to heat number and mill analysis. Reports to be provided by the supplier. All reinforcing steel shall have a number assigned to it corresponding to the placement mark on the submittal.
1. All steel bars that cannot be identified by heat number and mill analysis shall have one tensile and one bend test made for each 2-1/2 tons or fraction thereof, of each size and kind of reinforcing steel.
- Testing procedure shall conform to ASTM A615.
- B. No reinforcing steel shall be placed without an approved shop drawing.
- C. The testing laboratory shall verify size and location of all bars prior to concrete placement.
1. Verify that chairs or similar product have been provided and are in place for all slab reinforcement.
- D. A written report shall be submitted to the Engineer stating the results of the verification and any modifications required by the General Contractor to meet the plans and or specifications.

### 3.7 CONCRETE (Includes Special Inspection per CASE and IBC 2018)

- A. Portions of the following such as Engineered mix design are furnished by the installing Contractor; Testing of Concrete in the field is performed by the Testing Agency under the Owner.
- B. **After Contractors Mix design work is complete, field testing shall occur as follows:**
- a. Contractor or Testing Lab shall perform slump tests and take strength test cylinders (minimum of 5) at the point of application, or after it has been pumped, during first day's work. If a plasticizer is being used, test before and after addition of plasticizer and so note on the test report. Non compliant tests shall mean non-use of that trucks' product. All other days work shall be tested on every other truck after it has passed through the pumper.
  - b. Air entrainment tests shall be taken in the same manner as the concrete slump tests **but shall be taken by the Testing Laboratory.**
2. If slump or air content falls outside specified limits another test shall be made immediately from another portion of same batch. If this test likewise fails, the concrete of that load shall be discarded and the truck carrying it shall not be allowed to unload at the site for 1 hour. Truck identification number shall be recorded if this procedure is necessary
  3. Notify batch plant of mix irregularities and request materials and proportioning check
  4. Use and reporting of Field Samples:
    - a. Testing Lab shall perform laboratory strength tests on actual concrete work. Provide a single cylinder 7 day test and a final 28 day test with an average of 3

test cylinders, Keep one additional cylinder as a field hold to be tested in cold weather or as needed. A total of 5 (five)-test cylinders are required. Contractor may keep additional cylinders for use in determining form removal timing and to verify OSHA strength requirements for steel columns. Take daily tests on every 50 yards of each type of concrete used.

- b. Furnish certified compression test reports to Owner, Engineer, Architect and Concrete Contractor. On test report indicate following information:
  - Cylinder identification number and date cast.
  - Portion of structure and location of structure where tested
  - Type of concrete, slump and percent air.
  - Compressive strength of concrete in PSI.
  - Weather conditions during placing.
  - Temperature of concrete.
  - Maximum and minimum ambient temperature during placing.
  - Ambient temperature when concrete sample in test cylinder was taken.
  - Date delivered to laboratory and date tested.
  - Certification by the plant that the specified mix design and all required admixtures are included.
- 11. Verify thickness of concrete walls, slabs, raised slabs and other concrete work.
- 12. Verify that concrete meets FF and FL level and flatness standards listed in Section 03300 or 03300 Part 3 Execution The system is designed to measure 4' 20' x 20' test sections randomly chosen on the slab on grade and the raised deck floor not including stoops. The Sections should not adjoin each other unless the floor is less than 80'x 80' in size.
- 13. Verify that hot weather and or cold weather concrete installation requirements are being followed by the Contractor. If sufficient protections and methods are not being followed for the production, installation, protection and curing of concrete in cold weather or hot weather conditions, the pour must stop and only continue once conditions are remedied. See ACI 305R, ACI 306R.

**3.8 STRUCTURAL STEEL BEAMS, COLUMNS, JOISTS AND GIRDERS(Includes Special Inspection per CASE and IBC 2018)**

- A. Verify that anchor bolts and their setting pattern is at correct elevation, allows for 1-1/2" grout under the base plate and that pattern matches Contract Drawings and reviewed shop drawings.
- B. Welding:
  - 1. Field-welded connections shall be inspected visually.
    - a. Fillet Welds - 50% of all connections, closely visually inspected as per AWS D1.1.
    - b. Partial Penetration - 50% of all connections, closely visually inspected as per AWS D1.1.
    - c. Full Penetration - 50 % of all connections, closely visually inspected as per AWS D1.1.
  - 2. X ray testing of welded connections shall be required only if visual inspection determines that numerous (over 20%) flaws exist in the welding fillets and further visual inspection cannot be made to determine adequate welded connections.
- C. Bolted Connections: Per AISC, All bolted connections shall be bolted with ASTM A325, Type 1, 3/4" min. diameter bolts. All shear bolts at initial erection shall be snug fit tightened with a wrench.
  - 1. After final erection tightening and correction of plumb and square of steel; all shear bolt connections shall have the additional requirement of paint stick match marking. Paint shall mark the connection surface, the bolt, and the nut. A final 1/4" turn past snug fit with a wrench shall be required. Then the threads shall be welded or damaged

2. Quantity of Bearing Connections inspected is: 20% of total number of connections. Each bolt in tested connection shall be tested for snug fit.
  - a. Retighten 100% of bolts in tested connection if any bolts within tested connections are not adequately tightened.
  - b. Retighten 100% of ALL bearing style connections if more than 10% of the tested connections contain bolts not adequately tightened.
  - c. Retest system as defined above, if system has to be re-erected.
3. Steel members shall be inspected to plumb, square and level. The standards shall vary but in general shall be no more than 1/2" per 16'-0" individual member.

### **3.9 STEEL DECKING** (Includes Special Inspection per CASE and IBC 2018)

- A. The decking shall be marked as to thickness and type
  1. Decking must be supplied free of oil or lubricating fluids.
  2. If decking is to be painted, it must be primed and free from rust or excess abrasion.
  3. If decking is to be galvanized, the galvanizing must be free from abraded areas and the galvanizing shall be well bonded to all surfaces.
- B. Certification of the welder shall be made for the type and thickness of decking to be installed.
- C. Prior to work commencing, the welder shall assemble and weld at least two samples of deck material to a base steel section simulating the framing with one weld each sample. Twist the deck sample with respect to the base until failure occurs. If the decking tests or if the welds on shearing in torsion show the proper fusion area, the welds are satisfactory.
- D. Inspection of all welds and placement of decking shall occur before any covering materials are applied. 50% of all welds shall be inspected.
  1. Any areas that show burn-through shall be removed and replaced.
  2. Adequate bearing on base steel sections shall be verified.
  3. All openings larger than 6" shall have steel channel backup and bracing.

### **3.10 PRECAST STRUCTURAL CONCRETE**

- A. Scope of Work: The Testing Laboratory shall furnish the necessary technicians and equipment to perform the following tests and inspections. Schedule the time for visits to the precast plant in consultation with the Supplier, Architect, Engineer, and Owner. Submit a proposed unit price for each visit and base the total proposed price. Inspections shall be performed by a qualified technician with a minimum of two years of experience in precast concrete testing and inspection.
- B. Quality Assurance:
  1. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
- C. Source Inspection:
  1. Preliminary plant inspection prior to the start of fabrication including the following:
    - a. Inspection of the batching facilities including aggregate stock piles, material handling facilities, concrete batching and mixing facilities, and in plant concrete handling, placing, and consolidating procedures and equipment.
    - b. Inspection of the in-plant testing and curing facilities.
    - c. Inspection of the casting beds shall be made to check for cleanliness, alignment, and surface condition of the bed.
    - d. Inspection of the stressing blocks and stressing procedures including verification of the calibration of the stressing jacks to be used in the work.
    - e. A review of the concrete mix designs proposed for use in the work.

2. Inspection prior to placing concrete including the following:
    - a. Inspect formwork for finish condition, dimensions, and dimensional tolerances.
    - b. Verify reinforcing steel placement and concrete cover.
    - c. Inspect 100% of hardware and embedded items for proper size, location, and finish.
    - d. For prestressed members, observe and inspect the stressing operation recording the following information:
      - Initial and final gauge load reading during tendon stressing.
      - Tendon elongation measurement.
      - Obvious irregularities or stress loss during anchoring procedures.
  3. Inspection during concrete placement including the following:
    - a. Verify that environmental conditions and concrete temperatures are within the limits stipulated.
    - b. Verify that the proper class of concrete is being used for the members being poured.
    - c. Inspect plastic concrete to verify proper batching and mix consistency.
    - d. Verify the molding, curing and testing of concrete cylinders by the Precast Producer are in accordance with the specifications and project requirements.
  4. Inspection after concrete placement including the following:
    - a. For prestressed members:
      - Verify minimum concrete strength at time of stress transfer.
      - Witness transfer of stress to concrete and report procedures used including release sequence of multi-tendon transfer.
    - b. After form stripping:
      - Check dimensions of precast units.
      - Verify required cambers.
      - Visually inspect the precast units for proper finish, cracks, and other surface defects and imperfections.
- D. Field Inspection: Inspection of bearing conditions, members and connections shall include the following:
1. Inspect anchor rod layout, embedment, and bolt tightening to base plates.
  2. Check base plates for proper grouting.
  3. Check connection of bearing walls to foundation for proper bolting and grouting.
  4. For welded connections, check for proper location of embedded plates or angles. 100% of welded connections shall be visually inspected for completeness including weld types, locations, sizes, and lengths.
  5. Verify proper finish (painted or galvanized) of 100 % of steel connection plates and angles including touch-up of welds.
- E. Reporting:
1. The Testing Laboratory shall write an inspection report promptly after each plant and site visit for distribution to the parties specified.
  2. Any irregularities in the work shall be immediately reported by telephone to the Engineer and Architect.

### **3.11 MASONRY** (Includes Special Inspection per CASE and IBC 2018)

- A. Quality Assurance
1. Concrete Masonry Unit: For each type of concrete masonry unit indicated, verify compliance with ASTM C 90 and the strength required by design. Verification may be by reviewing certification from unit producer showing compliance.

2. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.
- B. Field Testing
1. Masonry Strength Testing
    - a. Verification Testing Frequency: Verification of masonry strength (f<sub>m</sub>) will be performed at the beginning of masonry construction and during construction for each 5,000 square feet of wall area or portion thereof.
    - b. Mortar
      - i. As construction begins, verify the proportions of the site-prepared mortar mix comply with the requirements of ASTM C 270 for the type specified.
      - ii. Verify the proportions of materials in premixed or preblended mortar comply with the requirements of ASTM C 270 for the type specified as delivered to the site.
    - c. Grout
      - i. Prior to grouting, verify the proportions of site-prepared grout mix comply with the requirements of ASTM C 476 for each type of grout used.
      - ii. Verify the proportions of materials in premixed or preblended grout comply with the requirements of ASTM C 476 as delivered to the site.
      - iii. For grout pre-mixed at a batch plant or otherwise not prepared on site, grout shall be sampled and tested in accordance with ASTM C 1019. Prepare one set of grout samples for testing at seven days and two sets for testing at 28 days.
    - d. For each type of wall construction indicated for testing, test representative masonry prisms by methods of sampling and testing of ASTM C 1314, and as follows:
      - i. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
      - ii. For concrete masonry prisms adhere to requirements as specified under preconstruction testing. Build prisms on job using same materials and methods as for wall construction. Store prisms in air at temperature not less than 65°F in a facility supplied by the contractor where they will be undisturbed for seven (7) days. After seven (7) days, transport to laboratory in a manner which will not disturb mortar bond.
      - iii. Cap each prism with suitable material to provide bearing surfaces on each end.
      - iv. The preparation of prisms shall be observed by the testing agency that will test the prisms.
    - e. Report test results in writing and in form specified under each test method, to Architect and Contractor, on same day tests are made.
    - f. Retests: Where prism tests indicate non-compliance with specified requirements, additional testing shall be performed at the frequency of two additional tests for each unsatisfactory test. The cost of such additional testing shall be the responsibility of the Contractor. Where retesting fails to indicate conformance with specified requirements, any masonry construction represented by unsatisfactory tests shall be removed and replaced with acceptable masonry construction.
    - g. Testing of Non-Shrink Grout for Base Plates and Bearing Plates
      - i. Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
      - ii. Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.
- C. Field Inspection
1. Mortar Joints: As construction begins, verify that mortar joints are being prepared in accordance with these specifications and ACI 530.1/ASCE 6/TMS 602.

2. Reinforcement and Connectors: Prior to grouting, verify the size, grade, type and placement of reinforcement and connectors is in compliance with specified requirements.
3. Grouting: Prior to any grouting procedure, the grout space shall be inspected to verify that it is clean and that cleanouts, if required, are in place and conform to requirements. Verify through continuous inspection that the placement of grout is in compliance with the requirements of the contract specifications and ACI 530.1/ASCE 6/TMS 602.
4. Anchors: Continuously inspect the installation of anchors including anchors of masonry to other structural members, frames, or construction verifying their type, size, location, and installation.
5. Anchors: Periodically verify the type, size and location of anchors including anchors of masonry to other structural members, frames, or construction is in compliance with specified requirements.
6. Anchors: Verify maximum anchor tightening torque for all post-installed anchors.
7. Welding of Reinforcing Bars: Observe the welding of reinforcing bars.
8. Installed items: Verify that installed flashing, weep holes, construction joints, control joints and wall vents are installed in accordance with specifications.

### **3.12 FINAL REPORTING**

- A. At the conclusion of the work, required to be inspected by the Testing Laboratory, a written report in binder form with an index shall be submitted as a permanent record to the Owner through the Structural Engineer of all tests, logs, comments and written reports.

**END OF SECTION**

**SECTION 015000  
TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Field offices.

**1.02 TEMPORARY UTILITIES**

- A. Owner will provide the following:
  - 1. Electrical power and metering, consisting of connection to existing facilities.
  - 2. Water supply, consisting of connection to existing facilities.

**1.03 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

**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.

**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 barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**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 EXTERIOR ENCLOSURES**

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

**1.08 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft. Job site security is the responsibility of the Contractor.

**1.09 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. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

#### **1.10 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

#### **1.11 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack 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.

#### **1.12 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 016000  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Transportation, handling, storage and protection.
- B. Product option requirements.
- C. Substitution limitations and procedures.
- D. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 SUBMITTALS**

- A. 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.
- B. 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.
- C. 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 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.

**2.02 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

**PART 3 EXECUTION**

**3.01 SUBSTITUTION PROCEDURES**

- A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- B. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. 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.
  - 4. Waives claims for additional costs or time extension that may subsequently become apparent.

**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.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.03 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.
- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

**SECTION 017000  
EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

**1.02 RELATED REQUIREMENTS**

- A. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

**1.03 PROJECT CONDITIONS**

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

**1.04 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner 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**

**2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

**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. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### **3.03 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.05 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 shown.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
  - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
  - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
- C. Remove existing work as indicated and as required to accomplish new work.

1. Remove items indicated on drawings.
  2. Relocate items indicated on drawings.
  3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
  4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  3. 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.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. Provide temporary connections as required to maintain existing systems in service.
  4. Verify that abandoned services serve only abandoned facilities.
  5. 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; patch holes left by removal using materials specified for new construction.
- E. 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.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
  2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

### **3.06 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
  1. Complete the work.
  2. Fit products together to integrate with other work.
  3. Provide openings for penetration of mechanical, electrical, and other services.
  4. Match work that has been cut to adjacent work.
  5. Repair areas adjacent to cuts to required condition.

6. Repair new work damaged by subsequent work.
  7. Remove samples of installed work for testing when requested.
  8. Remove and replace defective and non-conforming work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
  - E. Restore work with new products in accordance with requirements of Contract Documents.
  - F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
  - G. Patching:
    1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
    2. Match color, texture, and appearance.
    3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

### **3.07 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

### **3.08 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

### **3.09 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- D. Verify that wiring and support components for equipment are complete and tested.
- E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- F. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### **3.10 DEMONSTRATION AND INSTRUCTION**

- A. See Section 017900 - Demonstration and Training.



### **3.11 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.

### **3.12 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### **3.13 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
- D. 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.
- E. 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.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

**END OF SECTION**

**SECTION 017800  
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 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. 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. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 2. 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.
  - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- 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, prior to 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 3 EXECUTION**

**2.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.
- 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. 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.

**2.02 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For Each Product, Applied Material, and Finish:
- 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. 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.

### **2.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. 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. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- E. Provide servicing and lubrication schedule, and list of lubricants required.
- F. Include manufacturer's printed operation and maintenance instructions.
- G. Include sequence of operation by controls manufacturer.
- H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- I. Additional Requirements: As specified in individual product specification sections.

### **2.04 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.

**END OF SECTION**

**SECTION 017900  
DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Items specified in individual product Sections.

**1.02 RELATED REQUIREMENTS**

- A. Section 017800 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit to Architect for transmittal to Owner.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.

**1.04 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

**3.02 TRAINING - GENERAL**

- A. Conduct training on-site unless otherwise indicated.

- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  - 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
  - 1. Review the applicable O&M manuals.
  - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
  - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  - 6. Discuss common troubleshooting problems and solutions.
  - 7. Discuss any peculiarities of equipment installation or operation.
  - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  - 10. Review spare parts and tools required to be furnished by Contractor.
  - 11. Review spare parts suppliers and sources and procurement procedures.
- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

## **SECTION 024100 DEMOLITION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Selective demolition of building elements for alteration purposes.

#### **1.02 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.

### **PART 3 EXECUTION**

#### **2.01 SCOPE**

- A. Remove all items as specified on Drawing Sheets D101A, A101B, D100C and D400C.

#### **2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. 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.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 6. Do not close or obstruct roadways or sidewalks without permit.
  - 7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- 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. 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.

#### **2.03 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. 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.
- E. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

#### **2.04 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 shown.
  - 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 items indicated on drawings.
- C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
  - 1. 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.
  - 2. Verify that abandoned services serve only abandoned facilities before removal.
  - 3. 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.

## **2.05 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**



**SECTION 030516**  
**UNDERSLAB VAPOR BARRIER - STEGO**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sheet vapor barrier under concrete slabs on grade.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

**1.03 REFERENCE STANDARDS**

- A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs 2018a.
- B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs 2017.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit manufacturers' data on manufactured products.
- C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

- A. Underslab Vapor Barrier:
  - 1. Water Vapor Permeance: Not more than 0.010 perms, maximum.
  - 2. Thickness: 15 mils.
  - 3. Basis of Design:
    - a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil):  
[www.stegoindustries.com/#sle](http://www.stegoindustries.com/#sle).
    - b. Vapor Block by Raven Industries.
    - c. Substitutions: See Section 016000 - Product Requirements.
- B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

**3.02 INSTALLATION**

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.
- B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.
- C. Lap joints minimum 6 inches.
- D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
- E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.
- F. Repair damaged vapor retarder before covering with other materials.

**END OF SECTION**

## **SECTION 03 10 00**

### **CONCRETE FORMING AND ACCESSORIES**

#### **PART 1 - GENERAL**

##### **1.1 WORK INCLUDED**

- A. Forms for all cast in place concrete
- B. Form accessories.
- C. Stripping forms.
- D. Waterstops
- E. Formdeck for stoops
- F. Opening in forms for other effected work.
- G. Shoring and reshoring as required. See structural notes page and details.

##### **1.2 RELATED CONTRACT DOCUMENTS**

- A. Documents affecting work of this Section include, drawings and general provisions of Contract, all General and Supplementary Conditions and all other Division 0 and 1 Specification Sections.

##### **1.3 WORK INSTALLED BUT FURNISHED UNDER SECTIONS**

- A. Section 05 12 00 - Structural Steel: Steel fabrications attached to form work.

##### **1.4 RELATED WORK**

- A. Section 03 20 00 - Concrete Reinforcement.
- B. Section 03 30 00 –Cast-In-Place Concrete.
- C. Section 05 12 00– Structural Steel

##### **1.5 REFERENCES**

- A. ACI 301 - Specifications for Structural Concrete for Buildings.
- B. ACI 315 - Details and Detailing of Concrete Reinforcement.
- C. ACI 318 – Building Code Requirements for Structural Concrete.
- D. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures
- E. ACI 347 - Recommended Practice for Concrete Formwork.
- F. PS 1 - Construction and Industrial Plywood.
- G. ACI 117-Standard Specifications for Tolerances.

## **1.6 QUALITY ASSURANCE**

- A. Construct and erect concrete form work in accordance with ACI 301.
- B. Tolerances:
  - 1. See ACI 117.

## **1.7 CONTRACTORS RESPONSIBILITY FOR FORMWORK DESIGN AND REMOVAL**

- A. The form-work system shall be designed to support freshly place concrete and reinforcing materials, It shall transfer all concrete loads to the bearing soils or to completed construction in a safe manner at all times. Remove formwork, in a manner that does not damage the concrete or the elements of the project. Under the requirements of the construction documents, IBC, All local Building codes, ACI, OSHA and Local Workmen's Compensation; The contractor, and not the engineer or architect, shall provide engineering as required to meet this obligation.

## **PART 2 – PRODUCTS**

### **2.1 FORM MATERIALS** (Earth is not an approved forming material)(Conform to ACI 301 and ACI 347 for design, fabrication, erection and removal of forms.)

- A. Plywood: Douglas Fir or equal species; sound, undamaged sheets with straight edges, manufactured for concrete wall forms.
  - 1. Conform to Tables for form design in APA Form V-345, including strength.
- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.
- C. Steel: Minimum 16 gauge sheet, well matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- D. Form deck: 1.5C 20 gauge (min) ASTM A653 by Vulcraft or equal, galvanized in accordance with ASTM 924-94 to a min class of G90, unless otherwise noted on plans.
- E. Circular pier or round column forms: Cardboard waxed or plasticized forms such as Sonotube or equivalent.
- F. Do not leave aluminum materials, which may cause a corrosive reaction, embedded in the concrete. Aluminum forms are acceptable.

### **2.2 FORMWORK ACCESSORIES**

- A. Form Ties: factory fabricated, adjustable length, removable or snap off form ties which results in no metal being closer than 1 1/2" from surface of concrete when forms are removed.
- B. Form Release Agent: Colorless material that will not stain concrete, or absorb moisture.
  - 1. Do not allow form release agent to come in contact with reinforcing steel or inserts in the concrete.
- C. Fillets for Chamfered Corners: Wood strips or rigid plastic as detailed. 3/4" x 3/4".
- D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorage's: Sized as required; of strength and character to maintain form work in place while placing concrete.
- E. Shelf Angle Inserts

1. Wedge type inserts for 5/8" diameter bolts. Include horseshoe shims.
  2. Minimum capacity 2,100 pounds
- F. Dovetail Anchor Slots:
1. 1" deep with 5/8" throat, 24 gauge galvanized steel.
- G. Flashing Reglets: 3/4" deep with 1/4" throat, 26 gauge galvanized steel.
- H. PVC weeps: 3" diameter PVC pipe.
- I. Waterstops: See plans and details for location.
1. Extrudable non-leaching polyurethane products that will swell upon moisture contact.
    - a. Sika Products: SikaSwell S one part water swelled extruded polyurethane sealant, including special triangular shaped nozzle.
    - b. An equal approved product with one part polyurethane makeup that is free of bentonite or other leaching materials
  2. PVC Waterstop.
    - a. Unless otherwise noted within the construction documents, 4" Ribbed Center Bulb style shall be used at all cold formed joints in liquid bearing structures.
    - b. Waterstop shall have a minimum design head pressure capacity of 100' or greater.
    - c. PVC Waterstop must meet or exceed the performance required by U.S. Army Corps of Engineers Specification CRD-C 572-74.

## **PART 3 – EXECUTION**

### **3.1 INSPECTION**

- A. Verify lines, levels, and measurements before proceeding with formwork.
- B. Depth or thickness of concrete being formed is to be as shown on plans. No variation in thickness or depth is allowed. (i.e.) a 4" slab is not to be poured at 3-5/8".

### **3.2 PREPARATION**

- A. Arrange and assemble formwork to permit dismantling and stripping so that concrete is not damaged during its removal.
- B. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

### **3.3 ERECTION**

- A. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.
- B. Construct forms in accordance with ACI 301.

### **3.4 TOLERANCES**

- A. Set and maintain forms to provide completed surfaces meeting the tolerances given in ACI 117. See Part 1 of these specifications.
  - 1. Tolerances given in ACI 117 are not cumulative. Maximum tolerance for any formed surface, except footings, shall be one inch.

### 3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for work embedded in or passing thorough concrete. Fill these voids with a readily removable material to prevent entry of concrete into voids or:
  - 1. Use void forming systems of correct size for openings required in the concrete. Follow manufacturers' instructions for proper strength ratings of void forms.
- B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, including electrical boxes and conduit and other inserts.
  - 1. Ensure that forms will provide sufficient coverage for reinforcing. See Section 03200 for requirements.
- C. Install accessories in accordance with manufacturers' instructions level and plumb. Ensure items are not disturbed during concrete placement.
- D. Apply extruded waterstop in form locations as shown on plans and details. Form all joints as a continuous  $\frac{3}{4}$ " bead strictly according to the manufacturer's instructions so that waterstops are continuous.
  - 1. Following manufacturers' instructions, use largest of the 2 precut triangular nozzles to insure proper form and size of bead. Apply to clean, dry flat surfaces.
    - a. Depending on concrete thickness more than one bead may be required. Consult manufacturer's instructions.
  - 2. Waterstop must be allowed to pass through all form bulkheads. Notch bulkheads at end of all pour intersections.
    - a. **To prevent waterstop damage**, install 2-3 hours prior to any concrete pour where vertical height is more than 20 inches. Use of a tremie to limit concrete drop to 20 inches is required if waterstop is less than 2 days old.
    - b. If wall is higher than 10'-0" contact Engineer for use of SikaSwell Hose.
- E. Build in dovetail anchor slots. Install anchor slots in concrete walls, columns, piers, beams and spandrels deeper than 14 inches and wider than 16 inches which will be in contact with masonry or elsewhere as indicated on the Drawings. Install anchor slots vertically, spaced 16 inches on center.

### 3.6 FORM RELEASE AGENT APPLICATION

- A. Apply agent on formwork only in accordance with manufacturer's instructions.
  - 1. Apply prior to installation of reinforcing steel, anchoring devices or embedments.
  - 2. If unable to completely remove agent from unintended items, replace the reinforcing steel, anchors or embedments.

### 3.7 FORM REMOVAL

- A. Replace concrete damaged by early removal of forms. Consult ACI 318, 301 and the following:
  - 1. Do not remove forms, shoring or bracing until concrete has sufficient strength to support its own weight, and construction and design loads that may be imposed upon it.
  - 2. Temperatures below 50 degrees F will prolong the timing of form removal.
- B. Form removal timing: Contractor shall verify the exact timing of form removal using these minimum removal times based on 28 day strength design of concrete and ACI 318.
  - 1. Footings: 24 hours minimum.
  - 2. 12" Walls under 5'-0" and 5'0" columns: 36 hours minimum.
    - a. For walls thicker than 12" and up to 20" add 8 hours.
    - b. For walls thicker than 20" same as 3 below.
  - 3. Walls and columns over 5'-0": 72 hours minimum but not until concrete, by cylinder test, has reached 50% of its 28-day design strength.
  - 4. Beams, girders, raised decks or floors: 75% of its 28-day design strength. No time limit.
- C. Do not damage concrete surfaces during form removal.
- D. Reshoring: Reshoring is designed to allow concrete to deflect and support its own weight after initial set has occurred and forms have been removed. Remove forms and tightly place reshores only after initial concrete deflection. Do not remove reshores until concrete has reached its specified strength.
  - 1. Apply no construction loads or other loads to members being reshored
  - 2. Provide reshores for all two-way slabs until concrete reaches specified strength.
- E. Forms for post-tensioned members may be removed as soon as full post-tension has been applied. Provide reshores as for non-post-tensioned members.
- F. At removal of forms patch all locations where wire ties protrude through the concrete or are exposed. Use primer and Non Shrink grout to solidly fill these holes. Also patch and grind to provide a smooth formed finish where required. See Part 1 of these specifications.

### **3.8 ALLOWABLE FACE & CORNER FINISHES**

- A. Rough Form Finish: Concrete faces not exposed to view in the finished work shall have a rough form finish as defined by ACI 347.3.4 as a Class D finish. Holes shall be no larger than 3/8" and honeycombing or surface irregularities shall be no more than 1" in a 5'-0" area. However any exposed reinforcing steel or ties must be solidly grouted to match reinforcing coverage requirements.
- B. Smooth Form Finish: Concrete faces exposed to view in the finished work shall have a smooth form finish as defined by ACI 347.3.4 as a Class B surface. Class B surfaces have no more than 1/4 " abrupt or gradual irregularities in a 5'-0" area and no holes larger than 1/4" on the surface. The contractor shall grind the surface where necessary to comply with these ACI requirements.
- C. Prominently exposed Class A finish: Concrete faces exposed to view as part of the architectural design or surfaces to receive finishes of any type (paint, textured paint, etc.) shall receive an class A smooth form finish as defined by ACI 347.3.4. These class A surfaces have no more than 1/8 " abrupt or gradual irregularities in a 5'-0" area and no holes larger than 1/8"

on the surface. The contractor shall then fill all holes and grind the exposed surface to provide a finish compatible with a heavily scrutinized surface.

- D. Corners not exposed to view may be formed either square or chamfered.
- E. Corners exposed to view shall be square, smooth, solid, unbroken lines except where a chamfered surface is called for on architectural plans
  - 1. Chamfered Corners shall be formed with chamfer strips to produce uniformly straight lines and tight edge joints. Unless otherwise stated the chamfers shall be 3/4" along both adjoining planes of the concrete edge. Extend the edges of the chamfers to the end of the formed surface. Match adjacent changes of direction by mitering to produce a connection without breaks in appearance. See architectural plans for where chamfers are required.

### **3.9 CLEANING**

- A. Clean forms to remove foreign matter as erection proceeds.
- B. Ensure that water and debris drain to exterior through clean-out ports.

**END OF SECTION**



## **SECTION 03 20 00**

### **CONCRETE REINFORCING**

#### **PART 1 - GENERAL**

##### **1.1 WORK INCLUDED**

- A. Weldable and non-welded reinforcing steel bars, for cast-in-place concrete.
- B. Support chairs, bolster, bar supports, ties and spacers for supporting reinforcement.
- C. Adhesive installation of dowels and or bars into prior placed concrete, masonry or structure.

##### **1.2 RELATED CONTRACT DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 0 and 1 Specification Sections apply to this Section

##### **1.3 RELATED WORK**

- A. Division 2 Earth and Site work.
- B. Section 03 10 00 - Concrete Forming and Accessories
- C. Section 03 30 00 – Cast-In-Place Concrete.
- D. Division 04 – Masonry
- E. Section 05 12 00 – Structural Steel

##### **1.4 REFERENCES** (Except where noted use latest edition)

- A. ACI 301 - Specification for Structural Concrete for Buildings.
- B. ACI 350 – Code Requirements For Environmental Engineering Concrete Structures
- C. ACI 318 – Building Code Requirements for Structural Concrete
- D. ACI 315 - Details and Detailing of Concrete Reinforcement.
- E. ANSI/ASTM A82 - Cold Drawn Steel Wire for Concrete Reinforcement.
- F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.
- G. ASTM A 184/A - Welded Deformed Steel Bar Mats for Concrete Reinforcement.
- H. ANSI/AWS D1.4 - Structural Welding Code Reinforcing Steel.
- I. ASTM A615 – Standard Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- J. ASTM A706 – Welding Bars for Concrete Reinforcement.
- K. CRSI - Manual of Practice.

## **1.5 QUALITY ASSURANCE**

- A. Perform concrete reinforcement work in accordance with CRSI Manual of Standard Practice, and Documents 63 and 65.
- B. Conform to ACI.
- C. Have all reinforcing inspected by local authority and testing laboratory prior to concrete pour. See section 01 45 29.

## **1.6 SHOP DRAWINGS**

- A. Submit shop drawings in no more or no less than 4 copies. Shop drawings shall show arrangement and layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with CRSI standards.
- B. Allow a minimum of 7 calendar days for processing not including shipping times.
- C. Provide layout with gridline coordinates and dimensions. Provide in accordance with ACI publication SP-66 / 315R-94 and 315-92 detailing manual.
  - 1. Provide cutting / bending lists and cut through concrete details that show all sizes, spacing, concrete cover, locations, splices and quantities of reinforcing steel.
    - a. Supporting devices are part of the work and must be shown on the submittal.
- D. Make a request in writing to Heyer Engineering to use portions of original design contract document drawings for layout of their submittal. If agreed, comply with the following:
  - The title block, sheet numbers and all designers' stamps, signatures and references are removed and are never to be used by the fabricator or user.
  - Dimensions shown on contract documents are not verified and are not to be reused. Detailer shall create new dimensions from architectural contract documents for erection purposes. Gridlines only should be reused.
  - Non-reinforcing elements except for concrete or masonry shall be removed.
  - Details and elevations shown on contract documents are only for design and need to be completely redone by the detailer for erection purposes.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS**

- A. Non Welded Reinforcing Steel: ASTM A615, 60 ksi yield grade billet-steel deformed bars, uncoated finish. Also includes smooth dowels. Use at all locations where A706 type is not specifically stated.
  - 1. At construction joints, grease and wrap the exposed end portion of smooth dowels prior to next concrete pour.
  - 2. See Structural details for corner bar requirements in footings, foundations and masonry.
- B. Weldable Reinforcing Steel: ASTM A706 60 ksi yield grade low alloy steel deformed bars with uncoated finish. See locations required on plans and details.
- C. Welded Steel Wire Fabric: ASTM A185 plain type; uncoated finish. Where size not noted, use 6 x 6 W2.1 x W2.1.
  - 1. Must be flat sheets only. Coils or wire rolls are not permitted.
- D. Reinforcing supports:

1. For footing, wall, pier or foundation supports use stirrups or wire meeting either CRSI Class 1-2 gauge tie wire meeting ASTM A82.
2. Slab Reinforcing Supports: Use Stirrups, chairs, masonry materials, or concrete pre-placements meeting CRSI requirements. Wood materials are prohibited. Supports are to be furnished by material supplier unless masonry or concrete preplacements. Coordinate with contractor.

## **2.2 ACCESSORY MATERIALS**

- A. Tie Wire: ASTM A82; minimum 16 gauge, annealed type, black.
- B. Adhesive Anchoring Products See Section 051200 for materials to be used when rebar must be embedded into existing structures.

## **2.3 FABRICATION**

- A. Fabricate in accordance with ACI 315, providing concrete cover specified in this section.
- B. Locate reinforcing splices not indicated on Drawings at points of minimum stress. Indicate location of splices on shop drawings.
- C. If required in plans or details, weld reinforcing bars in accordance with ANSI/ASW D1.4.

## **2.4 JOBSITE STORAGE**

- A. Reinforcing steel shall be stored at site on timbers or planks, not concrete, which will keep steel free from mud and water. If storage is during winter months cover and ventilate.

# **PART 3 – EXECUTION**

## **3.1 INSPECTION**

- A. Prior to concrete placement all reinforcing shall be inspected by a Testing agency. See Section 01 45 29. This inspection shall verify that reinforcing is installed per the plans and specifications and is not contaminated with form lubricants. In case of a conflict between the plans and the submittal drawings promptly contact the Engineer for resolution.
- B. When the supporting medium is a raised platform inspect the platform or decking to insure that the substrate is the proper specified platform and that the finish of the deck is as specified.
- C. Prior to concrete placement, notify all required governmental authorities of the work to allow for their inspection and comment.
- D. Before placing concrete, clean reinforcement of foreign particles or coatings including form oils. If reinforcement cannot be completely cleaned, replace contaminated reinforcement.

## **3.2 COVERAGE**

- A. Maintain concrete cover around reinforcing as shown on structural plans and note sheet.

## **3.3 INSTALLATION**

- A. For slabs and exterior walkways adjacent to building if reinforcement is not shown install 6 x 6 W2.1 x W2.1 flat sheet Woven Wire Fabric. Do not use coils.

- B. Place, support, and secure reinforcement against displacement. Do not deviate from alignment or measurement.
- C. Provide ties, bar supports and other permanent methods of keeping reinforcing steel at required position in the concrete.
  - 1. Anchor bolts or dowels for structure above footings or foundations may be placed in the top of initial pour prior to set of that concrete pour, within 30 minutes. They must be placed correctly and have all concrete at the area of the insertion hand troweled to provide a smooth and level top of concrete surface.
  - 2. Retaining walls, however, must have all elements including anchor bolts or dowels placed and supported in the initial pour.
- D. Chair up all steel bar slab reinforcing. Do not allow reinforcing to be at bottom of slabs. **The process of lifting up bars during slab pouring is not permitted unless it is to lift it up onto pins or chairs, during pour, for permanent placement.**
  - 1. Slabs where bars are not properly placed shall be replaced at contractors' expense.
- E. **Where smooth dowel construction joints are utilized, grease and wrap one end of the dowel.**
- F. See plans and details for specific locations that call for weldable reinforcing steel. At these locations use A706 reinforcing steel.
- G. For drilling or placing bolts, rods, anchors or similar embedments into existing masonry or concrete whether vertical or horizontal use an adhesive anchorage system. See Section 05121 for products to use and temperature restrictions. Substrate must not be below 32°F.
- H. For masonry see placement details for horizontal, corner and vertical bars in masonry cores, bond beams, jambs and lintels on structural drawing sheets.

#### END OF SECTION

## **SECTION 03 30 00**

### **CAST-IN-PLACE CONCRETE**

#### **PART 1 - GENERAL**

##### **1.1 RELATED CONTRACT DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 00 and 01 Specification Sections apply to this section.

##### **1.2 WORK INCLUDED**

- A. Furnish and install all cast-in-place concrete for footings, foundations, piers, columns, exterior stoops, interior slab on grade and raised slabs, equipment pads and other work as shown on plans and details.
  - 1. Equipment pads and similar concrete items. Division 15 and 16 contractors are responsible only for dimension, location and layout of the pads. Contractor of this section shall furnish and install concrete. If pad is located on top of a precast or other raised deck, provide information to the general contractor to adjust deck load prior to manufacturer's design of deck.
- B. Protection of freshly poured and concrete undergoing curing.
- C. Shelters, heat and weather protection of Cast in Place Concrete.
- D. Pumping of Concrete materials if required.
- E. Water stops. (See section 03 10 00).
- F. Installation of metal angles, embeds and anchor bolts furnished by Division 5 into the concrete.
- G. Core fill grouting of masonry (installed by mason)
- H. Precast Concrete grout (installed by precast erector).
- I. Precast Topping (installed by this concrete contractor).
- J. Admixtures, curing compounds and accessories.
- K. Sawcutting control joints.
- L. ASTM and ACI standards of level and flatness.
- M. Grouting of all control and construction joints with cementitious products compatible with flooring glues prior to flooring installation.

##### **1.3 RELATED WORK**

- A. Division 02- Earthwork
- B. Section 03 10 00 - Concrete Forming and Accessories
- C. Section 03 20 00 - Concrete Reinforcing
- D. Section 03 – Precast Concrete

- E. Section 04 – Masonry
- F. Section 05 12 00 – Structural Steel Framing
- G. Section 05 21 00 – Steel Joist Framing
- H. Section 05 31 00 – Steel Decking

#### **1.4 REFERENCES** (Use latest publication date unless otherwise noted)

- A. ACI 301 – Standard Specifications for structural concrete for buildings. (THE FIELD GUIDE)
- B. ACI 315 – Details and Detailing of Concrete Reinforcement
- C. ACI 318 – Building code requirements for structural concrete
- D. ACI 350 – Code Requirements For Environmental Engineering Concrete Structures
- E. ASTM C33 - Concrete aggregates.
- F. ASTM C618 – Standard specification for coal fly ash- type C. Use Coal Creek brand of fly ash only.
- G. ASTM C94 - Ready-Mixed concrete.
- H. ASTM C150 - Portland cement.
- I. ASTM C260 - Air-Entraining admixtures for concrete.
- J. ASTM C494 - Chemical admixtures for concrete.
- K. ASTM C309 – Curing compounds for concrete.
- L. ACI 210-Guide to durable concrete.
- M. ASTM C171- Specification for sheet material for curing concrete.
- N. ASTM E1155 – Standard test method for determining (FF) Floor flatness and (FL) Floor levelness numbers.
- O. ACI C308 - Standard practice for curing concrete.
- P. ACI C305R – Hot weather concrete work.
- Q. ACI C306R – Cold weather concrete work.
- R. AASHTO M-148 for curing materials.
- S. ASTM C192- Test methods for concrete.
- T. ASTM C156 - Test method for moisture retention for concrete.
- U. ASTM C 295 - Petrographic examination of aggregates for concrete.

#### **1.5 QUALITY ASSURANCE**

- A. Perform work in accordance with ACI 301.
- B. Have a current copy of ACI 301 on the jobsite for reference during the work of this section.
- C. Dimensions as shown on Construction Drawings are as intended. Slabs listed as 4" shall be 4".

- D. If the Concrete provided does not meet these specifications, The Contractors' Independent Engineering & Testing Agency shall perform batch inspections for the design mix and shall sample and test mix ingredients until concrete quality is established to the satisfaction of these Specifications.

## 1.6 DESIGN & TESTING

Submit the design mixes 10 days prior to placing concrete. Receive Engineers' review prior to use. Mix designs shall be no more than one-year-old from the date they are to be used. The following information shall be provided for each design mix.

- (1) Fine and coarse aggregate gradations per ASTM C33.
- (2) Method of determination the mix design proportions.
- (3) Water/cement ratio.
- (4) Entrained and non-entrained air content of freshly poured concrete.
- (5) Compressive strength at 28 days per ASTM C 39.
- (6) Chloride ion content of the concrete per ASTM C1218.
- (7) The proportions and types of all cementitious materials and admixtures.
- (8) The Shale and deleterious contents of all aggregates used.
- (9) Slump. Including slump both prior and after introduction of plasticizers; if they are used.
- (10) Location where concrete is to be placed. (i.e.) footings, topping etc.

- B. After design mix is approved, the testing and analysis of jobsite delivered concrete will be performed under provisions of Section 01 45 23including:

1. Strength tests: 4 Cylinders (1-7day, average of 2-28 day, 1 field hold) per every 50 yards of each type of concrete for each days pour.
  - a. Contractor shall keep and test additional cylinders for use in his determination of form removal timing, for cold or hot weather verification and for OSHA required column strengths.
2. Slump tests at the point of application and before and after addition of plasticizer. Send back non-compliant trucks.
3. Air entrainment tests at same time as slump tests. Air tests in fresh concrete are intended to show current air content. Send back non-compliant trucks.

- D. Vehicles on which non-compliant concrete are delivered shall not be allowed to modify concrete to be in compliance. Vehicle shall return to redi-mix plant & offload non-compliant concrete prior to batching of new concrete. No rebatched, formerly rejected concrete shall be used.

## 1.7 SUBMITTALS

- A. Shop Drawings

1. Construction Joints: Submit drawings of proposed construction joint locations in concrete for slab-on-grade, walls and foundations. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on drawings.
2. Openings, Sleeves, and Cores: Submit drawings of all openings to be formed, sleeved, cored, or sawcut in cast-in-place elements. Drawings shall indicate size and location of openings, sleeves, or cores.
3. Embedded Items: Submit drawing showing all items to be embedded in concrete elements, including plates, angles, bolts and any non-structural items such as conduit. Drawings shall indicate locations, size, orientation and type of embedded item.
4. Anchor Rods: Submit drawings showing layout and details for steel templates used for placing anchor rods.

## PART 2 – PRODUCTS

### 2.1 CONCRETE PROPERTIES, MATERIALS & MIXING

- A. Concrete shall be plant redi-mix type meeting ASTM C94. Site mixed concrete is not acceptable.
- B. Proportion mixes in accordance with ACI 211.1.
- C. Compressive strength (ASTM C31) and C39): See Chart for individual requirements.
- D. Water: potable, clean and free of injurious quantities of substances known to be harmful to and conforming to ASTM C94.
  - 1. Water / cement ratio: To be calculated for each mixed design. See Chart for individual basic requirements
  - 2. Maximum water to cement ratio for exterior concrete subject to freeze thaw cycles shall be 0.45. Use 8.32 lbs. per gallon.
- E. Portland Cement: ASTM C 150, Type I / II or Type I. All shall be low Alkali. If acid resistance is needed use type II. If high early strength is required use type III or add a minimum of 47 lbs. to each mix. Each bag is 94 lbs.
  - 1. Use the minimum quantity to reach desired 28-day compressive strength +15% overage.
- F. Type C Fly Ash, meeting ASTM C618, from Coal Creek Plant in Stanton North Dakota. Maximum allowable percentage and allowable time of use is stated in Chart in Article 2.6.
- G. Fine aggregate: clean, durable and sound natural sand conforming to ASTM C33, #4 and down.
  - 1. Shale or deleterious content shall be no more than .5% for slabs and 1% for all other concrete.
- H. Course aggregate: clean, durable and sound natural processed gravel conforming to ASTM C33 and free of materials that can cause Alkali-silica reaction (ASR). See chart in Part 2 for maximum sizes.
  - 1. Shale or deleterious content shall be no more than .5% for slabs and 1% for all other concrete.
  - 2. Maximum size shall not exceed 33 1/3% of the depth of any slab section.
  - 3. Test course aggregate for ASR under ASTM C295 or ASTM C1260.
- I. Air content: Tested to ASTM C231. See chart in Part 2 for required fresh entrained quantities. All concrete has some non-entrained air.
- J. Slump: Tested to ASTM C 143. See chart in Part 2 for requirements.

### 2.2 COMMON CONCRETE ACCESSORIES AND ADDITIVES

- A. No products containing calcium chloride in a content of more than 0.06% of the cement weight in chloride ions or Thiocyanates will be permitted. See ASTM C494 and ACI 318. - **If additional admixtures are used after mix approval, notify the Structural Engineer.**
  - 1. **For all garage surfaces use a clear** Exterior curing and sealing products meeting ASTM C309 type 2 or ASTM C1315 type 2. Do not apply to freshly laid concrete undergoing its initial hydration process until 14 days.



2. Use an exterior curing compound for all exterior horizontal and exposed vertical surfaces. Product shall meet ASTM C309 Type 2, Class B. These products leave a white Dye.
3. Clear interior cure and seal products are required for interior slab concrete, where no floor covering or coating will be applied; they must meet ASTM C1315 type 2.
  - a. Verify that no floor covering or finish exists with Architect.
4. On interior slabs on grade or raised placed in an enclosed temperature controlled building where floor covering will be adhered. Use a resin type, dissipating concrete curing compound meeting AASHTO M-148, and ASTM C309 Type I Class B. Verify that product shall penetrate and not leave material on surface.
5. Wet curing materials for interior slab on grade or raised slab work where building has not been erected and concrete is exposed.
  - a. Burlap, cotton mats and rags, rugs or similar material under polyethylene sheets. Fabric must not have been previously used for sugar, fertilizer or acidic materials storage. Take care that material does not have dye which will stain the concrete. The material shall meet AASHTO M-147 and ASTM C156.
  - b. Combination poly and cloth sheets meeting ASTM C156.
6. Performed expansion and wall isolation joint Filler: Non extruded type joint filler constructed of asphalt impregnated fibers meeting ASTM D1751. Material shall be full depth of slab of edge joint and exposed width shall be 1/2".
7. Super plasticizer. Meeting ASTM C494F: For workability or for pumping the contractor may use a High Range Water Reducing Admixture/ or Super Plasticizer to go to a max. temporary slump of 6. Water must not be used to obtain this increase.
8. Mid Range Plasticizer. Meeting ASTM C494 Type D: Combination water reducer and agent to improve workability for concrete during placement, at a level less than a superplasticizer.
9. Water reducing admixtures: Water reducing admixtures meet ASTM C494, Type A.
10. Air Entraining: Tests to ASTM C231. Air content is shown on chart in Part 2 for individual types of concrete. Air entraining products must meet ASTM C260. All concrete does have some non-entrained air.
  - a. Adjust if using a super or midrange plasticizer.
11. Concrete Bonding Agents: If concrete is to be placed on top of existing concrete or masonry use products meeting ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
12. Non-Chloride Accelerating Admixtures: If a faster initial set up is desired, or is specified in chart, use products meeting ASTM C 494 Type C. Never use chlorides.

### **2.3 GROUT FOR STRUCTURAL METAL BASEPLATES AND DOWELS**

- A. See Section 05 12 00 for non-shrink non-metallic grout.
- B. Grout for dowels, See section 05 12 00 for adhesive anchoring systems.

### **2.4 GROUT FOR INTERIOR CONTROL JOINT, COLD JOINTS, CRACKS OR EXPANSION JOINT FILLING**

- A. Fill All Control Joints, construction joints and cracks over 1/16" in width except exterior required to

prior to flooring or colorant installation

1. Use a cementitious thin patch that can be applied from featheredge to 1" inch thick. Products must contain at least 80% ASTM C150 cementitious materials. Product shall self-bonding to clean dry concrete and meet ASTM C1157 performance and ASTM C191 for material set characteristics. Some of these require flooring glues to be applied within 24 hours.

## 2.5 CONCRETE MIXING AND TRANSPORTING

- A. Do not add water to concrete at the site except with the direct written approval of the Structural Engineer or Architect. Delivery trucks shall deliver with minimum drum revolutions. No concrete older than 90 minutes from time of mixing in the truck shall be used for the project. See Article 1.6 on non-complaint concrete trucks.

## 2.6 CONCRETE MATERIALS, TYPES, STRENGTHS AND ADDITIVES

- A. Install mixes that provide following minimum requirements:

1. Concrete design mixes shall have a min. 15% over-design of compressive strength.
3. Type C fly ash from Coal Creek Station in Stanton, North Dakota may be used up to the maximum percentages shown in non-cold weather conditions. Do not use fly ash within 48 hours prior to or 72 hours after an air temperature of 50 degrees or lower exists. Do not use from November 1<sup>st</sup> till April 15<sup>th</sup> where concrete is not in a 28-day environment where the temperature is kept above 50°. Fly ash will retard initial set.

### • Footings & Footing Pads

- Low Alkali Cementitious Product Types: Portland Type I or I/II  
Maximum 25% Fly Ash Allowed
- Maximum Aggregate Size: 1½"
- Max Slump: 5"
- 28 Day Compressive Strength: 3,000psi
- Max w/c Ratio: 0.55
- Allowed Admixtures; Air Entrainment: WRDA Series upon Approval  
Use of Entrained Air is Contractors Option

### • Foundation Walls, Columns, Piers, Grade Beams (IF NOT Exposed to Weather)

- Low Alkali Cementitious Product Types: Portland Type I or I/II  
Maximum 20% Fly Ash Allowed
- Maximum Aggregate Size: ¾"
- Max Slump: 4"
- 28 Day Compressive Strength: 4,500psi
- Max w/c Ratio: 0.53
- Allowed Admixtures; Air Entrainment: WRDA Series upon Approval  
Mid-Range Plasticizer With Prior Approval  
Use of Entrained Air is Contractors Option

### • Foundation Walls, Columns, Piers, Grade Beams (IF Exposed to Weather)

- Low Alkali Cementitious Product Types: Portland Type I or I/II  
Maximum 20% Fly Ash Allowed
- Maximum Aggregate Size: ¾"
- Max Slump: 4"
- 28 Day Compressive Strength: 4,500psi
- Max w/c Ratio: 0.45
- Allowed Admixtures; Air Entrainment: WRDA Series upon Approval  
Mid-Range Plasticizer OK  
Super Plasticizer With Prior Approval  
5%-7% Entrained Air

- **Interior Slabs on Grade and Metal Form Deck**
  - Low Alkali Cementitious Product Types: Portland Type I or I/II  
Maximum 20% Fly Ash Allowed (Will Retard Initial Set)
  - Maximum Aggregate Size: ¾"
  - Max Slump: 5"
  - 28 Day Compressive Strength: 4,500psi
  - Max w/c Ratio: 0.45
  - Allowed Admixtures; Air Entrainment: WRDA Series upon Approval  
Mid-Range Plasticizer With Prior Approval  
Super Plasticizer With Prior Approval  
5% Entrained Air is Contractors Option
  
- **Exterior Horizontal Concrete on Grade and Metal Form Deck**
  - Low Alkali Cementitious Product Types: Portland Type I or I/II  
Maximum 25% Fly Ash Allowed  
Use min. 564 Lbs. of Cementitious Materials
  - Maximum Aggregate Size: ¾"
  - Max Slump: 4"
  - 28 Day Compressive Strength: 4,500psi
  - Max w/c Ratio: 0.44
  - Allowed Admixtures; Air Entrainment: WRDA Series upon Approval  
Mid-Range Plasticizer OK  
Super Plasticizer With Prior Approval  
5%-7% Entrained Air
  
- **Precast Grout (NOT Topping)**
  - Low Alkali Cementitious Product Types: Portland Type I or I/II  
Maximum 25% Fly Ash Allowed  
6.5 Sack Minimum  
Use 8.5 Sack below 42F, See ACI 301
  - Maximum Aggregate Size: Sand Mix with ALL Material Passing a #16 Sieve
  - Max Slump: 6"
  - 28 Day Compressive Strength: 5,000psi  
(2,000psi Prior to Freeze/Thaw Exposure)  
(2,500psi at 7 Day Break)
  - Max w/c Ratio: 0.60
  - Allowed Admixtures; Air Entrainment: WRDA Series upon Approval  
Super Plasticizer OK  
Precast & Air <42F, Use Accelerator  
Heat All Components below 42F  
5%-7% Entrained Air
  
- **Grout for CMU Wall Core Fill and CMU Bond Beams**
  - Low Alkali Cementitious Product Types: Portland Type I  
Maximum 25% Fly Ash Allowed
  - Maximum Aggregate Size: 3/8" and min. 70% Fine Aggregate
  - Max Slump: 8"
  - 28 Day Compressive Strength: 3,000psi
  - Max w/c Ratio: 0.60
  - Allowed Admixtures; Air Entrainment: WRDA Series upon Approval  
Mid-Range Plasticizer OK  
Super Plasticizer is Prohibited  
5% Entrained Air is Contractors Option
  
- **Precast Topping and Stair Pan Fill**
  - Low Alkali Cementitious Product Types: Portland Type I or I/II  
Maximum 10% Fly Ash Allowed
  - Maximum Aggregate Size: 3/8" minus
  - Max Slump: 4"
  - 28 Day Compressive Strength: 4,000psi

- Max w/c Ratio 0.50
- Allowed Admixtures; Air Entrainment WRDA Series upon Approval  
Mid-Range Plasticizer With Prior Approval  
Super Plasticizer With Prior Approval  
No Entrained Air  
1½" Lbs./CY Fibermesh Reinforcement

## 2.7 RELATED PRODUCTS

### A. Post-Installed Anchors.

1. Mechanical Anchors: Only anchors having passed Acceptance Criteria 193 for use in cracked concrete and resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:
  - a. ICC Evaluation Service Report.
  - b. IAPMO Uniform Evaluation Services.
2. Adhesive Anchoring Systems: Only adhesive anchor systems that comply with the latest revision of ICC-ES Acceptance Criteria 308 for use in cracked concrete and resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:
  - a. ICC Evaluation Service Report.
  - b. IAPMO Uniform Evaluation Services.
3. Cold Weather Placement: See ACI 306R

### B. Anchor Rods:

1. ASTM F1554, Grade 36

### C. Non-Shrink Grout:

1. Type: Grout for base plates, bearing plates and grouting under precast or tilt-up wall panels shall be a non-metallic, shrinkage resistant, premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents and fluidity improving compounds.
2. Specifications: Non-shrink grout shall conform to ASTM C 1107.
3. Compressive Strength: Provide the minimum strength as shown below as determined by grout cube tests at 28 days:
  - a. 6,000 PSI for supporting concrete 3,000 PSI and less.
  - b. 8,000 PSI for supporting concrete greater than 3,000 PSI and less than or equal to 4,000 PSI.
  - c. Unless noted otherwise on the drawings, grout strength on supporting concrete greater than 4,000 PSI shall be 8,000 PSI.

## PART 3 – EXECUTION

### 3.1 INSPECTION AND PROTECTION

- A. Notify Engineer minimum 24 hours prior to commencement of concrete placement.
- B. Verify anchors, seats, plates, reinforcement, drains and other items to be cast into concrete are accurately placed, held securely, and will not cause hardship in placing concrete. Provide written verification as well as photographs of the area to be poured.
- C. Insure polyurethane waterstops have been installed for at least 3 hours prior to pour and that rigid waterstop types are continually supported.

- D. Work area and Concrete may be exposed to potentially hazardous damage after initial set has been achieved. Take measures to protect concrete from traffic, ladders, fluids and indentation during initial set and curing. Ladders and all materials with sharp edges must have protective plywood under the rungs or edges.

### **3.2 PREPARATION**

- A. Prepare existing concrete or masonry, for additional concrete by cleaning with steel brush and a neutral pH cleaning solution to insure removal of existing solvents, greases, plant products and other solutions. Apply an ASTM C1059 bonding agent in accordance with manufacturer's instructions.
- B. If concrete is to be placed on top of metal platforms, or decks, prepare metal surface by cleaning with an acid etching solution or vinegar. Do not place concrete if rust or oxidation is present. Notify Architect.
- C. If concrete is a slab to be placed on top of soil, insure that the soil is well compacted to specifications shown in earthwork section and that no debris or organic materials are present. Dampen the surface with water but do not flood.
- D. At any location where new concrete is doweled to existing work, use an adhesive anchoring system. See section 05 12 00.
- E. Protect and tape over all surfaces to be exposed, of all floor drains, openings and devices to be set into the concrete.
- F. Protect all concrete from freezing during placement and initial set. Under no circumstances can concrete be placed on top of frozen soil, snow, ice, and frozen precast or any other frozen object.

### **3.3 VAPOR RETARDER**

- A. For all interior Slab on Grade Concrete with flooring or a finish applied; A vapor retarder shall be placed directly above granular subbase.
- B. Use screed bars and platforms and means / methods keep vapor retarder unbroken.

### **3.4 PLACING CONCRETE**

- A. Place concrete in accordance with ACI 301. Keep an ACI 301 book on site for reference at all times.
  - 1. Do not allow a vertical drop of more than 5'-0" without use of a Tremie to prevent aggregate segregation.
  - 2. Hot Weather Placement: See ACI 305R
  - 3. Cold Weather Placement: See ACI 306R
- B. Ensure reinforcement, inserts, embedded parts, drains and formed joints are not disturbed during concrete placement. If movement occurs the concrete contractor must remove and replace the effected item and the effected concrete.
- C. See section 03 20 00 and structural notes sheet for minimum concrete cover.
- D. Use a minimum 1/8" per foot slope for all floor drains. Pitch entire room slab or maximum area of 20'- 0" and increase to 1/4" per foot of pitch in final 4'-0" of space around the drain. The concrete shall be worked well around all surfaces of the drain fitting.
- E. All slab reinforcing must be on chairs. Hand lifting without supports during pour is prohibited.

- F. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours that would cause new cold joints to occur.
- G. Excessive honeycombing or embedded debris in concrete is not acceptable. Contractor must replace or repair. See section 03 10 00, Part 3 for acceptable finishes.
- H. Concrete may be placed by means of a Concrete pumper. A plasticizer and a decrease in course aggregate size may be used only with permission of the Engineer when pumping is used. Cementitious content will need to be raised if aggregate size is modified. See requirements on slump and super plasticizer in Part 2.
- I. The concrete shall be screeded or struck off slightly above final elevation, then consolidated.
  - 1. Consolidate concrete by vibrating, so that concrete is thoroughly worked around reinforcement, around embedded items and into corners of forms to eliminate air or stone packers that may cause honeycombing, pitting or weakness.
    - a. Vibrating shall be done by experienced workers in a manner to eliminate consolidation. Do not vibrate forms or reinforcing materials.
  - 2. After consolidation the concrete shall not be further worked until finishing.
- J. Do not add water during placement or when finishing.
- K. Depth or thickness of concrete is to be as shown on the plans. No variation in thickness or depth is allowed.
  - 1. Slab concrete that is shown as 4 inches shall not be formed and poured at 3 5/8".
- L. Do not use cement or sand to take up excess surface water.

### **3.5 HORIZONTAL SURFACE FINISHING** (Including interior & exterior floors)

- A. Finish the concrete when the water sheen has disappeared and the surface has stiffened enough to permit the finishing operation. Follow ACI 302.1R.
- B. Types of final finishes are:
  - 1. For all interior flat exposed, resilient tile, or thin set ceramic tile covered floors float and then "Hard Steel Trowel Finish" the concrete surface in accordance with finishing class 5. This is designed to provide a smooth floor. Provide very close surface tolerances and no telegraphing of cementitious surfaces into the tile.
    - a. Use the same finish for carpet covered floors.
  - 2. For all interior floors that will have ceramic or material requiring a grout bed provide only a floated finish with a wood float surface that allows for a level but not perfectly smooth surface. Considered a class 1,2 or 3 surface, but without any final troweling.
  - 3. For all interior concrete that contains air entrainment of 3% or less, an aluminum or magnesium float followed by a "Hard Steel Trowel Finish" shall be applied. Class 2.
  - 4. For all exterior concrete that contains air entrainment, an aluminum or magnesium float followed by a "Light Soft Bristle Broom Finish" shall be applied.
  - 5. For all interior concrete that requires slip resistance, an aluminum or magnesium float, followed by minimal steel trowling for levelness and a "Light Soft Bristle Broom Finish" shall be applied.

6. See ACI 302.1R for class 6 and higher floors that are impact, high traffic or super flat.
- B. All concrete horizontal surfaces, including floors must be flat and level. The following chart shows ASTM E1155 values in an average commercial situation for a flat and level floor that shall be followed:
1.  $F_F$  defines the maximum floor curvature allowed over successive 24" measurements on a 20'-0" x 20'-0" floor or flat surface. It is concerned with floor waviness.
  2.  $F_L$  defines the maximum difference in elevations in decimals of an inch, between two points separated by 10'-0" taken any place on the floor. It is concerned with local levelness.
  3. The specified overall numbers are the maximum obtainable.
  4. The minimum localized numbers are the required expected values for the test section.
- C. A traditional method to determine floor flat and levelness is to place a 10'-0" flat level anywhere on the surface. No more than a 3/16" gap would be measured under the level at any place on the floor or interior or exterior surface. In the chart we have listed this traditional measurement **as a guide only.**
- D. The ASTM system is designed to measure 4 20' x 20' test sections randomly chosen on the floor or surface in question. The Sections should not adjoin each other unless the floor is less than 80' x 80' in size.

Types of concrete Horizontal surfaces &  Their Quality Classifications	Minimum FF / FL Numbers Required			Local Levelness Value	Maximum Clearance  Under a 10' Level
	Overall Flatness Value	Local Flatness Value	Overall Levelness Value		
Flat concrete base for grout bed	20	15	15	10	3/8"
Precast Topping Surface	30	20	15	10	3/16"
Raised Slab Surface	30	20	15	10	3/16"
Interior Slab on Grade surface	35	24	30	20	1 / 8"
Exterior & garage floors, stoops, paving surfaces	20	15	13	10	1 / 4"

### 3.6 CRACKS, EXPANSION, CONSTRUCTION, AND CONTRACTION JOINTS

- A. Horizontal and vertical construction joints in concrete shall be made only where shown for structural drawings and or approved by Engineer. All cold construction joints shall be provided with a suitable bonding agent at all grooves and keyways, and surfaces against which new concrete is to be laid shall be thoroughly cleaned with a stiff wire brush and water.
1. Where smooth dowel construction (cold) joints are used, grease and wrap the exposed end of the dowel to allow horizontal movement.
- B. Expansion joints at edges of the building or bay shall be filled with expansion material to within 3/4" of top of all adjacent slabs or edges and shall be located where shown on drawings. See Part 2 products for types of materials to use.

- C. Control joints shall be saw cut and located as shown on structural drawings. If not shown cut at intervals of (36 x slab thickness)" by (36 x slab thickness)" (+/- 5'-0"). Locate under wall partitions if possible.
  - 1. Saw cut control joints at an optimum time after finishing. Use 3/16-inch thick blade, cutting at least 1/4 into depth of slab thickness. (i.e.) 4" slab to be cut 1"+ deep. Fill saw cut control joint with a semi rigid joint filler, in accordance with ACI301, section 11.3.9. General Contractor is responsible for joint and semi rigid joint filler condition up to 90 days after building is occupied. After the 90 days, owner is responsible for joint maintenance.
- D. All exposed joints and cracks over 1/16" in interior concrete upon which flooring or colorants are to be applied shall be grouted solid with a cementitious grout acceptable to flooring glue manufacturer. Contractor shall install prior to flooring installation but after initial cracking and movement due to shrinkage is complete. Generally 28 days. See part 2 products for material to use. Coordinate with flooring work. Some products have a limited time for installation of flooring.
  - 1. All joints that are under walls or partitions or are unexposed shall be sealed with a semi rigid joint filler, in accordance with ACI 301, section 11.3.9.

### 3.7 CONCRETE CURING AND SEALING (See also ACI 308)

- A. All interior and exterior concrete must be kept between 55 and 80 degrees F and in a moist condition, to decrease water evaporation from the exposed surfaces during the first 7 days after placement.
  - 1. For building or shelter-enclosed concrete, Contractor may use temporary heaters provided that he vent all flue gases from units to the outside of the enclosure. Use only fresh outside air for combustion. All heaters of this type must also be equipped with a heat exchanger vented to the outside.
- B. All interior slabs receiving glued down flooring, either on grade or raised, that are enclosed by the building shall be kept between 55° and 80° F and cured in the following manner.
  - 1. Either use the method in Paragraph C.1. below or:
  - 2. After finish troweling apply a resin based dissipating cure product meeting ASTM C309 with no surface residue in a double cross coat application. This will provide moisture retention only. Keep foot and equipment traffic off the slab for 7 days. Use products that do not leave residue on slab surface. See Part 2 Products.
  - 3. **Do not apply to concrete that will have colorant or exposed aggregate.**
- C. All interior slabs, receiving glued down flooring either on grade or raised **that are exposed to weather and not enclosed** by the building during concrete pour and cure shall be kept between 55° and 80° F and cured in the following manner.
  - 1. Cover the slab with wet, non-ink containing burlap or similar material, under a 4-mil thick polyethylene plastic sheeting or a combination burlap / polyethylene cloth to retain moisture. Keep burlap or similar material moist and the slab cured in this manner for 7 days at a temperature range of 55 to 70 degrees F.
  - 2. Install materials to hold down the material.
  - 3. If high early strength, Type III, concrete is used and temperature is kept above 73 degrees the period of time of wet curing required may be reduced to 3 days.
- D. Allow the surface of the concrete to further cure and dry for a period of 28 days prior to exposure to epoxy finishes, flooring glues, hard surface traffic, steel wheels or shovels.
- E. All exterior exposed uncolored vertical or horizontal concrete shall have a white dye release curing



compound meeting ASTM C309 Type 2 applied.

1. See Part 2 Products and follow manufacturer recommendations & limitations for their use.
- F. All interior slabs, left uncovered and not receiving any finish, colorant or flooring, either on grade or raised shall have a curing and sealing compound meeting either ASTM C1315 Type 1 or C309 Type 1 applied.
1. See Part 2 Products for type and Architectural Plans for locations.
- G. **Interior athletic or vehicle traffic** use uncolored or covered concrete slabs shall have an exterior cure and seal compound meeting ASTM C1315 Type 2 applied. See Part 2 Products for type and Architectural Plans for locations.

### **3.8 GROUTING OF CORES IN MASONRY UNITS**

- A. Fill all cells containing reinforcing with grout once masonry units have reached sufficient strength to resist grout pressure.
1. Grout masonry units in a height that allows full access to each lift's cores. Generally no more than 4'-0" in height each lift.
  2. If core fill grout is to be placed in more than one lift, depress level of grout in first row of cells by 2" inches to insure an adequate bond on the following upper masonry layer.
  3. At the top surface of the masonry stack bond, strike off any excess material above the surface.
  4. At the top surface of the masonry stack bond, strike off any excess material above the surface.
- B. Keep cells to be filled clean.
- C. Center metal bars and dowels in the cells.
- D. Vibrate if necessary to ensure grout has reached entire depth of cell.

### **3.9 SETTING AND GROUTING OF STRUCTURAL METALS AND BASEPLATES**

- A. See section 05 12 00.
- B. Setting of anchor bolts is by this 03 30 00 Section using template, Contract Drawings and reviewed shop drawings from Section 05 12 00.

### **3.10 TOPPING CONCRETE**

- A. Install after all precast is set, all welding is complete and grouting is cured and reached its 28-day strength. (Topping is supplied and installed by this concrete contractor)

### **3.11 GROUTING OF PRECAST CONCRETE UNITS** (Grout is installed by precast erector)

- A. After all erection, bolting and welding of precast units and placement of reinforcing is completed, grout shall be placed. All edges of plank, columns or beams and all metal supports connections or embedments must be grouted full and shall match the level of the adjacent surface. (Grout is supplied and installed by the precast erector.)
1. See heating and covering requirements in 03 41 00 any time temperature of air is below 55F.

2. During summer comply with hot weather precautions stated in ACI 305R.

### **3.12 FOOTING & FOUNDATION CONCRETE**

- A. Do not use earth forms for footings.
- B. Insure that all forms are braced sufficiently to handle weight and shifting from pouring of concrete.
- C. Have an inspection done of all footings prior to pouring this concrete. Correct any reinforcement or form deficiencies prior to pouring. Do not imbed horizontal or cross bracing reinforcing after concrete has been poured. Dowels may be set after pouring but must be placed while concrete is still wet and pliable not after initial set. Drilling in dowels after set is not acceptable.
- D. Use vibration to insure that all concrete is solidly placed and that no voids or honeycombs are allowed to occur.
- E. Insure that top of footing concrete is level and able to receive masonry or concrete foundations without excessive dips or void areas.
- F. Keep forms in place until the concrete is sufficiently strong enough to avoid deflection. See Section 031000.
- G. During backfilling operations, brace foundation walls to prevent flexural distortion in curing concrete.

### **3.13 EXTERIOR CONCRETE**

- A. Insure that surface is not frozen on which concrete is to be poured. Protect finished product from freezing temperatures. See ACI 306 R.
- B. If concrete is placed in hot weather in temperature above 80 degrees, provide protection to all newly poured surfaces. See ACI 305R.
- C. Keep traffic off concrete until 75% of minimum required strength is attained by test.
- D. Follow ADA and local governmental requirements with regard to maintaining proper slope at pedestrian walkways.
- E. Provide a gradual slope to catch basins, drains and similar.
- F. Provide rounded surface to all edges of walks, drives or other horizontal concrete during finishing. Provide a light broom finish to all horizontal exposed surfaces.
- G. See Part 3 horizontal surface finishing for methods of curing and finishing exterior surfaces.

### **3.14 DEFECTIVE CONCRETE** (See Chapter 9 of ACI 301)

- A. Modify or replace concrete not conforming to required levels and lines, thickness, details, and elevations.
- B. Repair or replace concrete not properly placed, indented or damaged, not of the specified type, frozen, spalling, under strength by more than 15%, or improperly cured. Testing agency that designed concrete, Engineer and Architect shall be final arbiters of quality.

### **3.15 FIELD QUALITY CONTROL**

- A. See Division 01 and Part 1 of this specification

### **3.16 CLEANUP**

- A. At completion of each day's work, remove all concrete spillage and splash from adjacent areas and work.
1. If Glass has been effected carefully, remove particles using methods approved by the glazing manufacturer. Do not use products that could etch glass.
  2. Provide a disposal place for ready mix truck wash down. Do not allow wash down concrete to be deposited in the street, on finished landscaping or onto other work. Costs of cleanup of improperly disposed of wash down will be deducted from future payment and will include replacement of damaged or soiled property.

**END OF SECTION**

**SECTION 033511  
CONCRETE FLOOR FINISHES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface treatments for concrete floors and slabs.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with concrete floor placement and concrete floor curing.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

**1.05 MOCK-UP**

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

**1.07 FIELD CONDITIONS**

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F minimum.

**PART 2 PRODUCTS**

**2.01 DENSIFIERS AND HARDENERS**

- A. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
  - 1. Composition: Lithium silicate.
  - 2. Products:
    - a. ARDEX Engineered Cements; ARDEX PC-50: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. Euclid Chemical Company; ULTRASIL LI+: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
    - c. PROSOCO, Inc; Consolideck LS: [www.prosoco.com/consolideck/#sle](http://www.prosoco.com/consolideck/#sle).
    - d. Surface Koatings, Inc; Aqualon L-100: [www.surfkoat.com/#sle](http://www.surfkoat.com/#sle).
    - e. Basis of Design: SpecChem, LLC; LithSeal SC.
    - f. Substitutions: See Section 016000 - Product Requirements.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

**3.02 GENERAL**

- A. Apply materials in accordance with manufacturer's instructions.

**3.03 COATING APPLICATION**

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
- C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

**END OF SECTION**

**SECTION 034113**  
**PRECAST CONCRETE HOLLOW CORE PLANKS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Precast floor and roof planks.
- B. Connection plates with brackets and hangers.
- C. Grouting plank joint keys.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete.

**1.03 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Structural Concrete 2016.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- D. ASTM A416/A416M - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete 2018.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.
- F. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- G. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel 2018.
- H. IAS AC157 - Accreditation Criteria for Fabricator Inspection Programs for Reinforced and Precast/Prestressed Concrete 2017.
- I. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products 1999.
- J. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete 2017.
- K. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete 1988.
- L. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete 1989.
- M. PCI MNL-126 - Manual For The Design of Hollow Core Slabs 2015.
- N. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction 2000.
- O. PCI (CERT) - PCI Plant Certification Current Edition.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate location of hanger tabs and devices for mechanical and electrical work and cutting of field openings.
- B. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Discuss anchor and weld plate locations, sleeve locations, and cautions regarding cutting or core drilling.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate standard component configuration, design loads, deflections, and cambers.
- C. Shop Drawings: Indicate plank locations, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, and relationship to adjacent materials.
  - 1. Submit design calculations.
- D. Welders' Certificates.
- E. Designer's Qualification Statement.

- F. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.

## **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design precast concrete hollow core planks under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- C. Fabricator Qualifications: Precast concrete fabricator accredited by IAS according to IAS AC157.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Precast Concrete Hollow Core Planks:
  - 1. Any manufacturer with PCI Plant Certification.
  - 2. Substitutions: See Section 016000 - Product Requirements.

### **2.02 PRECAST UNITS**

- A. Precast Hollow Core Planks: Comply with PCI MNL-120, PCI MNL-126, PCI MNL-124 ACI 318, and ACI 301.
  - 1. Dimensions as indicated on drawings.
  - 2. Design components to withstand dead loads and design loads in the configuration indicated on drawings and as follows:
    - a. Roof Assembly: See plan.
    - b. Floor Assembly: See plan.
    - c. Maximum Allowable Deflection of Roof Planks: 1/240 of span (total) and 1/360 of span (live), cambered to achieve slope to drain.
    - d. Maximum Allowable Deflection of Floor Planks: 1/240 of span (total load) and 1/360 (live load), cambered to achieve flat surface under dead load.
  - 3. Design connections in accordance with PCI MNL-123.
  - 4. Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

### **2.03 MATERIALS**

- A. Concrete Materials: ACI 301.
- B. Tensioning Steel Tendons: ASTM A416/A416M, Grade 250 - 250K psi (1725 MPa); seven-wire stranded steel cable; low-relaxation type; full length without splices; weldless; uncoated.
- C. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa) deformed steel bars.
- D. Non-Shrink Grout: Non-metallic, minimum compressive strength of 10,000 psi (69 MPa) at 28 days.
- E. Cement Grout: Minimum compressive strength of 3,000 psi (21 MPa) at 28 days.

### **2.04 ACCESSORIES**

- A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts: ASTM A36/A36M carbon steel; prime painted.
- B. Core Hole End Plugs: Cardboard insert with stiff concrete fill.
- C. Hanger Tabs: Galvanized steel, designed to fit into grouted key joints, capable of supporting 500 lbs (225 Kg) dead load, predrilled to receive hanger.

- D. Bearing Pads: High density plastic, 1/8 inch (3 mm) thick, smooth on one side. Vulcanized elastomeric compound molded to size.
- E. Sill Seal: Compressible glass fiber strips.

## **2.05 FABRICATION**

- A. Weld reinforcing in accordance with AWS D1.4/D1.4M.
- B. Embed anchors, inserts, plates, angles, and other items at locations indicated.
- C. Provide openings required by other sections, at locations indicated.
- D. Cut exposed ends flush.
- E. Plant Finish: Finish members to PCI MNL-116 Commercial Grade.
- F. Connecting and Supporting Steel Devices: Do not paint surfaces in contact with concrete or surfaces requiring field welding.

## **2.06 FABRICATION TOLERANCES**

- A. Comply with PCI MNL-116 and PCI MNL-135, except as specifically amended below.
  - 1. Maximum Variation From Nominal Dimensions:
    - a. Width: Plus or minus 1/4 in (6 mm).
    - b. Length: Plus or minus 1/2 in (12 mm).
    - c. Depth: Plus or minus 1/4 in (6 mm).
  - 2. Maximum Variation From Intended Camber: Plus or minus 1/4 inch in 10 feet (2 mm per m).
  - 3. Maximum Variation from Plan End Squareness: Plus or minus 1/4 in (6 mm).
  - 4. Maximum Sweep: Plus or minus 1/4 in (6 mm).
  - 5. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch (3 mm).
  - 6. Maximum Bowing of Members: Length/360.
  - 7. Maximum Bowing of Members: Plus or minus 1/4 inch in 10 feet (2 mm per m) to a maximum of 3/8 inch (10 mm).

## **2.07 SOURCE QUALITY CONTROL**

- A. Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that site conditions are ready to receive work and field measurements are as indicated on shop drawings.

### **3.02 PREPARATION**

- A. Prepare support devices for the erection procedure and temporary bracing.

### **3.03 ERECTION**

- A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.
- B. Install bearing pads and sill seal at bearing ends of planks as indicated.
- C. Align and maintain uniform horizontal and end joints, as erection progresses.
- D. Maintain temporary bracing in place until final connection is made. Protect members from staining.
- E. Adjust differential camber between precast members to tolerance before final attachment and grouting.
- F. Adjust differential elevation between precast members to tolerance before final attachment.
- G. Secure units in place. Perform welding in accordance with AWS D1.1/D1.1M.
- H. Grout longitudinal keys as indicated.



- I. Make plank-to-plank joints smooth using grout, troweled smooth. Transition differential elevation of adjoining planks with grout to a maximum slope of 1:12.

### **3.04 TOLERANCES**

- A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135, except as specifically amended below.
  1. Plan Location from Building Grid Datum: Plus or minus 3/4 in (19 mm).
  2. Top Elevation from Building Elevation Datum at Plank Ends: Plus or minus 1/2 inch (12.5 mm).
  3. Maximum Jog in Alignment of Matching Ends: Plus or minus 1/2 inch (12.5 mm).
  4. Exposed Joint Dimension: Plus or minus 3/8 inch (9 mm).
  5. Differential Top Elevation As Erected: Plus or minus 3/8 inch (9 mm).
  6. Bearing Length in Span Direction: Plus or minus 3/8 inch (9 mm).
  7. Differential Bottom Elevation of Exposed Planks: Plus or minus 3/16 inch (4.5 mm).

### **3.05 PROTECTION**

- A. Protect members from damage caused by field welding or erection operations.

### **3.06 CLEANING**

- A. Clean weld marks, dirt, and blemishes from surface of exposed members.

**END OF SECTION**

**SECTION 034500  
PRECAST ARCHITECTURAL CONCRETE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Architectural precast concrete wall panels with integral insulation and precast accent units.
- B. Supports, anchors, and attachments.
- C. Grouting under panels.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Admixtures.
- B. Section 079200 - Joint Sealants: Sealing perimeter and intermediate joints.

**1.03 REFERENCE STANDARDS**

- A. ACI 301 - Specifications for Structural Concrete 2016.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary 2014 (Errata 2018).
- C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength 2014.
- E. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric) 2014.
- F. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts 2015.
- G. ASTM C150/C150M - Standard Specification for Portland Cement 2020.
- H. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete 2019.
- I. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.
- J. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars 2018a.
- K. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures 2020.
- L. ASTM F436 - Standard Specification for Hardened Steel Washers 2011.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a minimum of one week prior to commencing work of this section.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.
- C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, integral insulation, insulated panel system connectors, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials. Provide erection drawings.
  - 1. Include details of mix designs.
  - 2. Include structural design calculations.
- D. Samples: Submit two 1" thick, 12 by 12 inch in size, illustrating surface finish, color and texture.

- E. Integrally Insulated Panel System Manufacturer's Installation Instructions: Submit manufacturer's current installation instructions for system specified. Certify that copies are available at fabrication site prior to start of precast fabrication
- F. Integrally Insulated Panel System Design Data:
  - 1. Thermal Resistance: Submit calculations complying with ASHRAE Std 90.1 I-P, isothermal planes method, and demonstrating thermal resistance of integrally insulated panel system.
- G. Maintenance Data: Indicate surface cleaning instructions.

## **1.06 QUALITY ASSURANCE**

- A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in the State in which the Project is located.
- B. Fabricator Qualifications:
  - 1. Firm having at least 5 years of documented experience in production of precast concrete of the type required.
- C. Erector Qualifications:
  - 1. The precast concrete erector shall not have less than 2 years of experience in the erection of precast structural concrete similar to the requirements of this project. Upon request, provide written evidence that equipment and personnel are adequate and qualified for performance of contract requirements.

## **1.07 MOCK-UP**

- A. Provide one mock-up, 4 feet long by 4 feet wide, with lifting device, and attachment points, and finish in accordance with approved sample.
- B. Locate where directed.

## **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Handling: Lift and support precast units only from support points.
- B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.
- C. Protect units to prevent staining, chipping, or spalling of concrete.
- D. Mark units with date of production in location that will be concealed after installation.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Architectural Precast Concrete:
  - 1. Any manufacturer holding a PCI Group A Plant Certification for the types of products specified; see [www.pci.org/#sle](http://www.pci.org/#sle).
  - 2. Substitutions: See Section 016000 - Product Requirements.

### **2.02 PRECAST UNITS**

- A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
  - 1. Concrete Face Mix: Minimum 5000 psi, 28 day strength, air entrained to 5 to 7 percent; comply with ACI 301.
  - 2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
  - 3. Calculate structural properties of units in accordance with ACI 318.
  - 4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
  - 5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.
- B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

### **2.03 REINFORCEMENT**

- A. Steel Welded Wire Reinforcement (WWR): Plain type ASTM A1064/A1064M.
  - 1. Form: Flat Sheets.

### **2.04 CONCRETE MATERIALS**

- A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
- B. Other Cementitious Materials:
  - 1. Fly Ash or Natural Pozzolans: Comply with ASTM C618.
  - 2. Ground Granulated Blast Furnace Slag: ASTM C989/C989M.
  - 3. Silica Fume: Comply with ASTM C1240.
- C. Fine and Coarse Structural Aggregates: ASTM C33.
- D. Lightweight Structural Aggregate: ASTM C330.
- E. Mix Design:
  - 1. Platte River Sand (45%) and Granite Falls Sand (55%).
  - 2. 3/4" Sweetman Quartzite (20%) and Granite Falls CA-70 (80%).
  - 3. 1.5% Cove Grey DCS Coloring
- F. Finish: Light Medium Sandblast finish.
- G. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
- H. Water: Clean and not detrimental to concrete.
- I. Grout:
  - 1. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

### **2.05 SUPPORT DEVICES**

- A. Bolts, Nuts, and Washers: ASTM A325 (A 325M) heavy hex structural bolts, Type 1, plain, with matching ASTM A563 (A563M) nuts, and washers as follows:
  - 1. Standard Washers: ASTM F436 washers, in finish matching bolts.

### **2.06 INTEGRALLY INSULATED PANEL SYSTEM (TRUSS CONNECTORS)**

- A. Integrally Insulated Panel System: Precast concrete panel formed from two layers of concrete with rigid insulation and non-conducting truss connectors between layers.
  - 1. Connectors: System manufacturer's standard; epoxy coated, interlaid carbon fiber mesh.
  - 2. Continuous Insulation: Rigid expanded polystyrene (EPS) board insulation; ASTM C578, Type II.

### **2.07 ACCESSORIES**

- A. Bearing Pads: High density plastic; Shore A Durometer .; 1/8 inch thick, smooth both sides.
- B. Maintain consistent quality during manufacture.
- C. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
- D. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.
- E. Integrally Insulated Panel System: Comply with manufacturer's written installation instructions.
- F. Remove protective coating from thin brick using method recommended by manufacturer. Do not damage brick or concrete material in joints.

### **2.08 FABRICATION TOLERANCES**

- A. Conform to PCI MNL-117 and PCI MNL-135.
  - 1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in.
  - 2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet.
  - 3. Maximum Variation from Thickness: Plus or minus 1/8 in.
  - 4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.
  - 5. Maximum Bowing of Members: Plus or minus length/360.

## **2.09 ACCESSORIES**

- A. Bearing Pads: High density plastic; Shore A Durometer [\_\_\_\_]; 1/8 inch thick, smooth both sides.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

### **3.02 PREPARATION**

- A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.
- B. All Cranes, operators and welders need to be certified.
- C. Align and maintain uniform horizontal and vertical joints as erection progresses.
- D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.
- E. Weld units in place. Perform welding in accordance with AWS D1.1/D1.1M.
- F. Provide non-combustible shields during welding operations.
- G. Touch-up field welds and scratched or damaged primed painted surfaces.
- H. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.

### **3.03 TOLERANCES**

- A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.
  - 1. Plan Location from Building Grid Datum: Plus or minus 3/8 in.
  - 2. Top Elevation from Nominal Top Elevation: Plus or minus 3/8 inch.
  - 3. Maximum Plumb Variation Over Height of Structure or 100 ft (whichever is less): Plus or minus 1/2 inch.
  - 4. Exposed Joint Dimension: Plus or minus 3/16 inch.
  - 5. Maximum Jog in Alignment of Matching Faces or Edges: Plus or minus 3/16 inch.
  - 6. Differential Bowing or Camber as Erected Between Similar Adjacent Members: Plus or minus 3/16 inch.

**END OF SECTION**

**SECTION 042000  
UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete Block.
- B. Mortar and Grout.
- C. Reinforcement and Anchorage.
- D. Flashings.
- E. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications: Loose steel lintels.
- B. Section 061000 - Rough Carpentry: Nailing strips built into masonry.
- C. Section 079200 - Joint Sealants: Sealing control and expansion joints.

**1.03 REFERENCE STANDARDS**

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2020.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2018a.
- F. ASTM C91/C91M - Standard Specification for Masonry Cement 2018.
- G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar 2018.
- H. ASTM C150/C150M - Standard Specification for Portland Cement 2020.
- I. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale) 2019.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019.
- K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.
- L. ASTM C476 - Standard Specification for Grout for Masonry 2020.
- M. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.
- N. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2016.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit panel samples of facing brick units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

#### **1.07 MOCK-UP**

- A. Construct a masonry wall as a mock-up panel sized 4 feet long by 4 feet high; include mortar, accessories, and flashings (with lap joint, corner, and end dam) in mock-up.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

### **PART 2 PRODUCTS**

#### **2.01 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
  2. Load-Bearing Units: ASTM C90, normal weight.
    - a. Hollow block, as indicated.
    - b. Exposed Faces: Manufacturer's standard color and texture where indicated.

#### **2.02 MORTAR AND GROUT MATERIALS**

- A. Masonry Cement: ASTM C91/C91M, Type N.
- B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
  1. Not more than 0.60 percent alkali.
- C. Mortar Aggregate: ASTM C144.
- D. Grout Aggregate: ASTM C404.
- E. Water: Clean and potable.

#### **2.03 REINFORCEMENT AND ANCHORAGE**

- A. Manufacturers of Joint Reinforcement and Anchors:
  1. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
  2. Hohmann & Barnard, Inc; 2-Seal Tie: [www.h-b.com/#sle](http://www.h-b.com/#sle).
  3. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
  4. Substitutions: See Section 016000 - Product Requirements.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; galvanized.
- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- D. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
- E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
  1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
  2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
  3. Vertical adjustment: Not less than 3-1/2 inches.
- F. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

## **2.04 FLASHINGS**

- A. Copper/Kraft Paper Flashings: 3 oz/sq ft sheet copper bonded to fiber reinforced asphalt treated Kraft paper.
  - 1. Manufacturers:
    - a. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gage, 0.0187 inch thick; finish 2B to 2D.

## **2.05 ACCESSORIES**

- A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
  - 1. Manufacturers:
    - a. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
    - b. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - c. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
- B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
  - 1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
    - a. Manufacturers:
      - 1) Advanced Building Products Inc; Mortar Break  
DT: [www.advancedflashing.com/#sle](http://www.advancedflashing.com/#sle).
      - 2) Mortar Net Solutions: [www.mortarnet.com](http://www.mortarnet.com).
      - 3) Substitutions: See Section 016000 - Product Requirements.
- C. Termination Bars: Stainless steel; compatible with membrane and adhesives.
- D. Drip Edge: Stainless steel; compatible with membrane and adhesives.
- E. Type: Polyester mesh.
- F. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## **2.06 MORTAR AND GROUT MIXES**

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  - 1. Exterior, non-loadbearing masonry: Type N.
  - 2. Interior, loadbearing masonry: Type N.
  - 3. Interior, non-loadbearing masonry: Type O.
- B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.
- D. Mixing: Use mechanical batch mixer and comply with referenced standards.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### **3.02 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### **3.03 COLD AND HOT WEATHER REQUIREMENTS**



- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

#### **3.04 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.
- D. Brick Units:
  - 1. Bond: Stacked.
  - 2. Coursing: Two units and two mortar joints to equal 8 inches.
  - 3. Mortar Joints: Concave.

#### **3.05 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Lay hollow masonry units with face shell bedding on head and bed joints.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- G. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- H. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

#### **3.06 WEEPS/CAVITY VENTS**

- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.
- B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

#### **3.07 CAVITY MORTAR CONTROL**

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

#### **3.08 REINFORCEMENT AND ANCHORAGE - GENERAL**

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.

#### **3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER**

- A. Install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

### **3.10 MASONRY FLASHINGS**

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
- B. Extend metal flashings to within 1/4 inch of exterior face of masonry.

### **3.11 CONTROL AND EXPANSION JOINTS**

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

### **3.12 BUILT-IN WORK**

- A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### **3.13 TOLERANCES**

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### **3.14 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Clean soiled surfaces with cleaning solution.

### **3.15 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

## **STRUCTURAL STEEL FRAMING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Structural steel framing members, support members.
- B. Base plates, expansion joint plates.
- C. Grouting under base plates.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 2100 - Steel Joist Framing.
- B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

#### **1.03 REFERENCE STANDARDS**

- A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2011.
- B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2012.
- F. ASTM A514/A514M - Standard Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2005 (Reapproved 2009).
- G. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011.
- H. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2013.
- I. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; International Accreditation Service, Inc.; 2011.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
- C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

#### **1.05 QUALITY ASSURANCE**

- A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."
- B. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.
- C. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Steel Angles and Plates: ASTM A36/A36M.

- B. Steel W Shapes and Tees: ASTM A992/A992M.
- C. Rolled Steel Structural Shapes: ASTM A992/A992M.
- D. Steel Plate: ASTM A514/A514M.
- E. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A galvanized to ASTM A 153/A 153M, Class C.
- F. Welding Materials: AWS D1.1; type required for materials being welded.
- G. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi (48 MPa) at 28 days.
- H. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

## **2.02 FABRICATION**

- A. Shop fabricate to greatest extent possible.
- B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
- C. Fabricate connections for bolt, nut, and washer connectors.

## **2.03 FINISH**

- A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

## **3.02 ERECTION**

- A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges".
- B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of Architect.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.
- E. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

## **3.03 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.

**END OF SECTION**

## **STEEL JOIST FRAMING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Open web steel joists, with bridging, attached seats and anchors.
- B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
- C. Supplementary framing for roof openings greater than 18 inches (450 mm).

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing.
- B. Section 05 3100 - Steel Decking: Bearing plates and angles.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2012.
- D. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- E. SJI (SPEC) - Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders; Steel Joist Institute; 2011.
- F. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).
- G. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
- C. Design Calculations: Submit design calculations for all joists showing complete geometry and member sizes, including web and chord member splices to verify compliance with these specifications, contract drawings, and SJI specifications. Calculations shall be signed and sealed by a licensed engineer in the state where the project is located.
- D. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
- E. Manufacturer's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Transport, handle, store, and protect products to SJI requirements.

#### **1.06 QUALITY ASSURANCE**

- A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.
- B. Qualifications:

The steel joist manufacturer shall be a firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance for a minimum of 2 years.

The steel joist manufacturer must show evidence of compliance with the submittal, testing, and inspection requirements of the Steel Joist Institute (SJI) Standard Specifications for verification of design and manufacturing.

- C. Design and Manufacturing: Provide joists designed and manufactured in compliance with the following, and as herein specified.  
Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for K and LH/DLH Series Steel Joists and Joist Girders, latest edition.  
Design top and bottom chords for additional bending stresses resulting from a vertical concentrated load of 100 pounds (service) located anywhere between panel points. This load is used only for a bending check of the chord members.  
Recommended Code of Standard Practice for Steel Joists and Joist Girders, latest edition.  
SJI Technical Digest #8 "Welding of Open Web Steel Joists"  
Comply with all OSHA requirements.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Steel Joists:
1. Nucor-Vulcraft Group: [www.vulcraft.com](http://www.vulcraft.com).
  2. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 MATERIALS**

- A. Open Web Joists: SJI Type K Joists:
1. Minimum End Bearing on Steel Supports: As shown on the drawings.
  2. Minimum End Bearing on Concrete or Masonry Supports: As shown on drawings.
  3. Finish: Shop primed.
- B. Anchor Bolts, Nuts and Washers: ASTM A 307, hot-dip galvanized per ASTM A 153/A 153M, Class C.
- C. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.
- D. Welding Materials: AWS D1.1; type required for materials being welded.
- E. Shop and Touch-Up Primer: SSPC-Paint 25, zinc oxide, complying with VOC limitations of authorities having jurisdiction.

### **2.03 FINISH**

- A. Shop prime joists as specified.
- B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

### **3.02 ERECTION**

- A. Erect joists with correct bearing on supports.
- B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
- C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
- D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
- E. Install supplementary framing for floor and roof openings greater than 18 inches (450 mm).
- F. Do not permit erection of decking until joists are braced bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

- G. Do not field cut or alter structural members without approval of joist manufacturer.

### **3.03 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

### **3.04 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000.

**END OF SECTION**

## **STEEL DECKING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Acoustical roof deck.
- B. Roof deck.
- C. Supplementary framing for openings up to and including 18 inches (450 mm).
- D. Bearing plates and angles.
- E. Acoustical insulation in roof deck flutes.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.
- B. Section 05 2100 - Steel Joist Framing: Support framing for openings larger than 18 inches (450 mm) and shear stud connectors.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- C. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- D. AWS D1.3 - Structural Welding Code - Sheet Steel; American Welding Society; 2008.
- E. SDI (DM) - Publication No.31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute; 2007.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
- C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
- D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

#### **1.05 QUALITY ASSURANCE**

- A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Steel Deck:
  - 1. Cordeck, Inc: [www.cordeck.com](http://www.cordeck.com).
  - 2. Nucor-Vulcraft Group: [www.vulcraft.com](http://www.vulcraft.com).

#### **2.02 STEEL DECK**

- A. Acoustical Roof Deck: Non-composite type, steel sheet with plain vertical flute faces perforated with 1/8 inch (3 mm) diameter holes staggered 3/8 inch (10 mm) on center:
  - 1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
  - 2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.
  - 3. Minimum Metal Thickness, Excluding Finish: 22 gage (0.8 mm).



4. Nominal Height: 1-1/2 inch (38 mm).
  5. Profile: Fluted; SDI NR.
  6. Side Joints: Lapped, welded.
  7. End Joints: Lapped, welded.
- B. Non-composite Form Deck Non-composite type, fluted steel sheet:
1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade **33/230** zinc coating.
  2. Metal Thickness: See Plan
  3. Nominal Height: 1 inch (1.0C deck)
  4. Formed Sheet Width: 32 inch (minimum)
  5. Side Joints: See plan.
  6. End Joints: See plan.
- C. Roof Deck: Non-composite type, fluted steel sheet:
1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
  2. Minimum Metal Thickness, Excluding Finish: 20 gage (0.8 mm).
  3. Nominal Height: 1-1/2 inch (38 mm).
  4. Profile: Fluted; SDI NR.
  5. Formed Sheet Width: 24 inch (600 mm).
  6. Side Joints: Lock seam.
  7. End Joints: Lapped, welded.

## **2.03 ACCESSORY MATERIALS**

- A. Bearing Plates and Angles: ASTM A36/A36M steel, unfinished.
- B. Welding Materials: AWS D1.1.
- C. Fasteners: Galvanized hardened steel, self tapping.
- D. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft (18 kg/cu m) density; profiled to suit deck.

## **2.04 FABRICATED DECK ACCESSORIES**

- A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage (0.8 mm) thick sheet steel; of profile and size as indicated; finished same as deck.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions prior to beginning work.

### **3.02 INSTALLATION**

- A. On steel supports provide minimum 1-1/2 inch (38 mm) bearing.
- B. Fasten deck to steel support members at ends and intermediate supports at 12 inches (300 mm) on center maximum, parallel with the deck flute and at each transverse flute using methods specified.
  1. Welding: Use fusion welds through weld washers.
- C. Clinch lock seam side laps.
- D. At welded male/female side laps weld at 18 inches (450 mm) on center maximum.
- E. Weld deck in accordance with AWS D1.3.
- F. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

**END OF SECTION**

**SECTION 054000**  
**COLD-FORMED METAL FRAMING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Formed steel stud exterior wall and interior wall framing.
- B. Exterior wall sheathing.
- C. Water-resistive barrier over sheathing.

**1.02 RELATED REQUIREMENTS**

- A. Section 04 2001 - Masonry Veneer: Veneer masonry supported by wall stud metal framing.
- B. Section 05 3100 - Steel Decking.

**1.03 REFERENCE STANDARDS**

- A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.
- D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.
- E. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Metal Framing:
  - 1. Clarkwestern Dietrich Building Systems LLC: [www.clarkdietrich.com](http://www.clarkdietrich.com).
  - 2. Marino: [www.marinoware.com](http://www.marinoware.com).
  - 3. The Steel Network, Inc: [www.SteelNetwork.com](http://www.SteelNetwork.com).
  - 4. MBA Metal Framing: [www.mbastuds.com](http://www.mbastuds.com)
  - 5. Substitutions: See Section 01 6000 - Product Requirements.
- B. Framing Connectors and Accessories:
  - 1. Simpson Strong Tie: [www.strongtie.com](http://www.strongtie.com).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 FRAMING SYSTEM**

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

## **2.03 FRAMING MATERIALS**

- A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
- B. Framing Connectors: Factory-made, formed steel sheet.
  - 1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for thicknesses less than 10 gage (0.118 inch) (3 mm), and factory punched holes and slots.
  - 2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members.
  - 3. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

## **2.04 ACCESSORIES**

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Water-Resistive Barrier: As specified in Section 07 2500.

## **2.05 FASTENERS**

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

## **3.02 INSTALLATION OF STUDS**

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- E. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- F. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

## **3.03 WALL SHEATHING**

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
  - 1. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

**END OF SECTION**

**SECTION 055000  
METAL FABRICATIONS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Shop fabricated steel and aluminum items.
- B. Prefabricated ladders.
- C. Bollards

**1.02 RELATED REQUIREMENTS**

- A. Section 042000 - Unit Masonry: Placement of metal fabrications in masonry.
- B. Section 055100 - Metal Stairs.
- C. Section 055213 - Pipe and Tube Railings.

**1.03 REFERENCE STANDARDS**

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2018.
- B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- D. 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.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- G. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2012.
- H. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric) 2012.
- I. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.
- J. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.
- K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.
- L. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- N. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

**1.05 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

#### **1.06 MATERIALS - ALUMINUM**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.
- E. Bolts, Nuts, and Washers: Stainless steel.
- F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

#### **1.07 FABRICATION**

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

#### **1.08 FABRICATED ITEMS**

- A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.
- B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.
- C. Lintels: As detailed; prime paint finish.

#### **1.09 PREFABRICATED LADDERS**

- A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
  - 1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
  - 2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
  - 3. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
  - 4. Products: Basis of Design- Okeeffe's Inc.; Model 503A.
    - a. Industrial Ladder & Scaffolding, Inc.: [www.anyladder.com/sle](http://www.anyladder.com/sle).
    - b. Substitutions: See Section 016000 - Product Requirements.

#### **1.10 FINISHES - STEEL**

- A. Prime paint steel items.
  - 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.

- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

#### **1.11 FINISHES - ALUMINUM**

- A. Exterior Aluminum Surfaces: Class I natural anodized.
- B. Interior Aluminum Surfaces: Class I natural anodized.

#### **1.12 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

### **PART 3 EXECUTION**

#### **2.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

#### **2.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

#### **2.03 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.

#### **2.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

## **SECTION 055100 METAL STAIRS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Stairs with concrete treads.
- B. Structural steel stair framing and supports.
- C. Handrails and guards.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Concrete fill in stair pans.
- B. Section 055000 - Metal Fabrications.
- C. Section 099123 - Interior Painting: Paint finish.

#### **1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures 2006.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2012.
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020.
- I. SSPC-SP 2 - Hand Tool Cleaning 2018.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
  - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Welders' Certificates.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

#### **1.05 QUALITY ASSURANCE**

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.
- C. Fabricator Qualifications:
  - 1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

### **PART 2 PRODUCTS**

#### **2.01 METAL STAIRS - GENERAL**

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
  - 1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
  - 2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
  - 3. Structural Design: Provide complete stair and railing assemblies complying with the following:
  - 4. Dimensions: As indicated on drawings.
  - 5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
  - 6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
  - 7. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:
  - 1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
    - a. Welded Joints: Continuously welded and ground smooth and flush.
    - b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
    - c. Exposed Edges and Corners: Eased to small uniform radius.
    - d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

## **2.02 METAL STAIRS WITH CONCRETE TREADS**

- A. Jointing and Finish Quality Level: Industrial, as defined above.
- B. Risers: Closed.
- C. Treads: Metal pan with field-installed concrete fill.
  - 1. Concrete Depth: 1-1/2 inches, minimum.
  - 2. Tread Pan Material: Steel sheet.
  - 3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
  - 4. Concrete Reinforcement: None.
- D. Risers: Same material and thickness as tread pans.
  - 1. Nosing Depth: Not more than 1-1/2 inch overhang.
  - 2. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.
- E. Stringers: Rolled steel channels.
  - 1. Stringer Depth: As indicated on drawings.
- F. Railings: Steel pipe railings.
- G. Finish: Shop- or factory-prime painted.

## **2.03 HANDRAILS AND GUARDS**

- A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
  - 1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
- B. Guards:
  - 1. Top Rails: Round pipe or tube rails unless otherwise indicated.
    - a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
  - 2. End and Intermediate Posts: Same material and size as top rails.
    - a. Horizontal Spacing: As indicated on drawings.
    - b. Mounting: Welded to top surface of stringer.

## **2.04 MATERIALS**

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.



- C. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- D. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
- E. Concrete Fill: Portland cement Type I, 3000 psi 28 day strength, 2 to 3 inch slump.

## **2.05 SHOP FINISHING**

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime Painting: Use specified shop- and touch-up primer.
  - 1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
  - 2. Number of Coats: One.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.02 PREPARATION**

- A. When field welding is required, clean and strip primed steel items to bare metal.

### **3.03 INSTALLATION**

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- E. Obtain approval prior to site cutting or creating adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.

**END OF SECTION**

**SECTION 055213  
PIPE AND TUBE RAILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.
- D. Balcony railings and guardrails.

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 055100 - Metal Stairs: Attachment plates for handrails specified in this section.
- C. Section 099000 - Painting and Coating.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2016.
- D. ASTM B429/B429M - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube 2020.
- E. ASTM B483/B483M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Tubes for General Purpose Applications 2020.
- F. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- G. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
- C. Samples: Submit two, 6 inch long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Handrails, Railings, Guardrails and Aluminum Balconies:
  - 1. Alumi-Guard: [www.alumi-guard.com/sle](http://www.alumi-guard.com/sle).
  - 2. C.R. Laurence Company, Inc: [www.crl-arch.com/sle](http://www.crl-arch.com/sle).
  - 3. Kee Safety, Inc: [www.keesafety.com](http://www.keesafety.com).
  - 4. KaneSterling: [www.sterlingdula.com](http://www.sterlingdula.com).
  - 5. The Wagner Companies: [www.wagnercompanies.com](http://www.wagnercompanies.com).
  - 6. Substitutions: See Section 016000 - Product Requirements.

**2.02 RAILINGS - GENERAL REQUIREMENTS**

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
- G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

### **2.03 ALUMINUM MATERIALS**

- A. Aluminum Pipe: Schedule 40; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.
- B. Aluminum Tube: Minimum wall thickness of 0.127 inch; ASTM B429/B429M, ASTM B241/B241M, or ASTM B483/B483M.

### **2.04 STEEL RAILING SYSTEM**

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Exposed Fasteners: No exposed bolts or screws.
- E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

### **2.05 CABLE RAILING SYSTEM**

- A. Infill at cable railings:
  - 1. Material: Marine Grade 316 stainless steel.
  - 2. Size: 5/32" - 3/16"
  - 3. Hardware: Provide all stainless steel accessories for a complete system.
- B. Wood Top Rail: Hardwood stained to match Architect's sample. See drawings for dimensions.

### **2.06 FABRICATION**

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
  - 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
  - 2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
  - 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

### **2.07 ALUMINUM FINISHES**

- A. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system.
- B. Color: To be selected by Architect from manufacturer's full line.
- C. Touch-Up Materials: As recommended by coating manufacturer for field application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

**END OF SECTION**

## **SECTION 061000 ROUGH CARPENTRY**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Rough opening framing for doors, windows, and roof openings.
- B. Sheathing.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Miscellaneous framing and sheathing.
- F. Communications and electrical room mounting boards.
- G. Miscellaneous wood nailers, furring, and grounds.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 072500 - Weather Barriers: Water-resistive barrier over sheathing.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood 2018.
- C. PS 20 - American Softwood Lumber Standard 2020.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.
- D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

### **PART 2 PRODUCTS**

#### **2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
  - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee ([www.alsc.org](http://www.alsc.org)) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

#### **2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.
- D. Wall Sheathing: Glass mat faced gypsum, ASTM C1177/C1177M, 5/8 inch Type X fire resistant.
  - 1. Edges: Square.

2. Manufacturers:
  - a. CertainTeed Corporation; GlasRoc Brand: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - b. Georgia-Pacific Gypsum; DensGlass Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - c. Substitutions: See Section 016000 - Product Requirements.

### **2.03 ACCESSORIES**

- A. Fasteners and Anchors:
  1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Water-Resistive Barrier: As specified in Section 072500.

### **2.04 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Preservative Treatment:
  1. Manufacturers:
    - a. Lonza Group: [www.wolmanizedwood.com/#sle](http://www.wolmanizedwood.com/#sle).
    - b. Koppers Performance Chemicals, Inc; [ ]: [www.koppersperformancechemicals.com/#sle](http://www.koppersperformancechemicals.com/#sle).
    - c. Viance, LLC: [www.treatedwood.com](http://www.treatedwood.com).
    - d. Osmose, Inc: [www.osmose.com](http://www.osmose.com).
    - e. Substitutions: See Section 016000 - Product Requirements.
  2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
    - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
    - b. Treat lumber in contact with roofing, flashing, or waterproofing.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.
- B. Coordinate installation of rough carpentry members specified in other sections.

### **3.02 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

### **3.03 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

### **3.04 ROOF-RELATED CARPENTRY**

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where prefabricated curbs are specified and where specifically indicated otherwise. Form corners by alternating lapping side members.

### **3.05 INSTALLATION OF CONSTRUCTION PANELS**

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and

into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

### **3.06 CLEANING**

- A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION**

**SECTION 064100  
ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Cabinet hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 123600 - Countertops.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- B. BHMA A156.9 - American National Standard for Cabinet Hardware 2015.
- C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- D. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- E. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- C. Product Data: Provide data for hardware accessories.

**1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

**1.07 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

**PART 2 PRODUCTS**

**2.01 CABINETS**

- A. Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
  - 2. Finish - Concealed Surfaces: Manufacturer's option.
  - 3. Door and Drawer Front Edge Profiles: 3 mm edge band.
  - 4. Adjustable Shelf Loading: 50 lbs. per sq. ft.
  - 5. Cabinet Style: Flush overlay.
  - 6. Drawer Side Construction: Multiple-dovetailed.
  - 7. Drawer Construction Technique: Dovetail joints.

**2.02 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.

**2.03 LAMINATE MATERIALS**

- A. Manufacturers:
  - 1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  - 2. Wilsonart: [www.wilsonart.com](http://www.wilsonart.com).
  - 3. Pionite.
  - 4. Nevamar
  - 5. Substitutions: See Section 016000 - Product Requirements.



- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

## **2.04 COUNTERTOPS**

- A. Countertops are specified in Section 123600.

## **2.05 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
  - 1. Color: As selected by Architect from manufacturer's standard range.
- C. Acrylic Resin Panels: 3form Chroma. See Finish Schedule for colors
- D. Fasteners: Size and type to suit application.
- E. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and chrome-plated finish in exposed locations.
- F. Concealed Joint Fasteners: Threaded steel.
- G. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

## **2.06 HARDWARE**

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome, painted, or painted finish, for nominal 1 inch spacing adjustments.
- C. Countertop Supports:
  - 1. Material: Aluminum
  - 2. Finish/Color: Black powdercoat.
  - 3. Manufacturers:
    - a. Rakks/Rangine Corporation; Sill Supports: [www.rakks.com/#sle](http://www.rakks.com/#sle)
- D. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
- E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- F. Catches: Magnetic.
- G. Drawer Slides:
  - 1. Type: Extension types as scheduled.
  - 2. Static Load Capacity: Commercial grade.
  - 3. Mounting: Side mounted.
  - 4. Stops: Integral type.
  - 5. Manufacturers
    - a. Accuride International, Inc: [www.accuride.com](http://www.accuride.com).
    - b. Grass America Inc: [www.grassusa.com](http://www.grassusa.com).
    - c. Hettich America, LP: [www.hettichamerica.com](http://www.hettichamerica.com).
    - d. Knappe & Vogt Manufacturing Company: [www.knappeandvogt.com](http://www.knappeandvogt.com).
    - e. Substitutions: See Section 016000 - Product Requirements.
- H. Hinges: European style concealed self-closing type, steel with polished finish.
  - 1. Manufacturers:
    - a. Grass America Inc: [www.grassusa.com](http://www.grassusa.com).
    - b. Hardware Resources: [www.hardwareresources.com](http://www.hardwareresources.com).
    - c. Hettich America, LP; Sensys: [www.hettichamerica.com/#sle](http://www.hettichamerica.com/#sle).
    - d. Julius Blum, Inc: [www.blum.com](http://www.blum.com).
    - e. Substitutions: See Section 016000 - Product Requirements.
- I. Glass Doors: CRL Blumcraft 1301 Series Door; 3/8" thickness
- J. Glass Shelves:
  - 1. 1/4 inch clear tempered glass with flat-polished edges.
  - 2. Shelf Depth: As indicated on drawings.
  - 3. Shelves per Unit: Three.

- K. Shelf Standards and Brackets: Single-slotted channel standards for brackets adjustable in 1 inch increments along entire length of standard, drilled and countersunk for screws.
  - 1. Standards Mounting: Recess-mounted into back panel.
  - 2. Face Width: 5/8 inch.
  - 3. Material: 16 gage, 0.0598 inch sheet steel.
  - 4. Lengths: As indicated on drawings.
  - 5. Finish: Anochrome.
  - 6. Brackets: Boltless with lip front; 16 gage, 0.0598 inch sheet steel, reinforced, locking into slots; size to suit shelves; same finish as standards.
- L. Tackable Back Panel: Fine-grained, homogeneous natural cork on hardboard.
  - 1. Fabric: Vinyl fabric; minimum fabric weight: 13 oz/sq yd.
  - 2. Color, Texture, Weave, and Pattern: As selected from manufacturer's full range.
  - 3. Backing: Hardboard, 1/4 inch thick, factory laminated to tack surface.
  - 4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- M. Sliding Door Track Assemblies: Upper and lower track of satin anodized aluminum, with matching shoe equipped with nylon rollers.

## **2.07 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
  - 1. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.
- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

### **3.02 INSTALLATION**

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use concealed joint fasteners to align and secure adjoining cabinet units.
- C. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

### **3.03 ADJUSTING**

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.

### **3.04 CLEANING**

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

## **END OF SECTION**

**SECTION 068316  
FIBERGLASS REINFORCED PANELING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fiberglass reinforced plastic panels.
- B. Trim.

**1.02 REFERENCE STANDARDS**

- A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2017.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fiberglass Reinforced Plastic Panels:
  - 1. Marlite, Inc: [www.marlite.com/#sle](http://www.marlite.com/#sle).
  - 2. Nudo Products, Inc: [www.nudo.com/#sle](http://www.nudo.com/#sle).
  - 3. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  - 4. Basis of Design Glasbord by Crane Composites
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 PANEL SYSTEMS**

- A. Wall Panels:
  - 1. Panel Size: 4 by 10 feet.
  - 2. Panel Thickness: 0.09 inch.
  - 3. Surface Design: Embossed.
  - 4. Color: Smooth White.
  - 5. Attachment Method: Adhesive only, sealant joints, no trim.

**2.03 MATERIALS**

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
  - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Trim: Vinyl; color coordinating with panel.
- C. Sealant: Type recommended by panel manufacturer; white.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

**3.02 INSTALLATION - WALLS**

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

**END OF SECTION**

**SECTION 071400  
FLUID-APPLIED WATERPROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fluid-Applied Waterproofing:

**1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.
- B. Section 072100 - Thermal Insulation: Insulation used for protective cover.

**1.03 REFERENCE STANDARDS**

- A. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers 2017.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Polyurethane Waterproofing:
  - 1. AVM Industries, Inc: [www.avmindustries.com/#sle](http://www.avmindustries.com/#sle).
  - 2. Carlisle Coatings & Waterproofing, Inc: [www.carlisleccw.com/#sle](http://www.carlisleccw.com/#sle).
  - 3. CETCO, a division of Minerals Technologies Inc; [\_\_\_\_]: [www.mineralstech.com/#sle](http://www.mineralstech.com/#sle).
  - 4. Karnak Corporation; [\_\_\_\_]: [www.karnakcorp.com/#sle](http://www.karnakcorp.com/#sle).
  - 5. Master Builders Solutions by BASF: [www.master-builders-solutions.basf.us/en-us/#sle](http://www.master-builders-solutions.basf.us/en-us/#sle).
  - 6. Tremco Commercial Sealants & Waterproofing; TREMproof 250GC: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 7. Substitutions: See Section 016000 - Product Requirements.

**2.02 FLUID APPLIED WATERPROOFING MATERIALS**

- A. Polyurethane Waterproofing: Cold-applied one or two component polyurethane, complying with ASTM C836/C836M.
  - 1. Tensile Strength: 400 psi, measured in accordance with ASTM D412.
  - 2. Ultimate Elongation: 180 percent, measured in accordance with ASTM D412.
  - 3. Permeance: 0.073 perms, measured in accordance with ASTM E96/E96M.
  - 4. Brittleness Temperature: Based on minus 50 degrees F, measured in accordance with ASTM D746.

**2.03 ACCESSORIES**

- A. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.
- B. Protection Board: Rigid insulation specified in Section 072100.
- C. Drainage Panel: 1/4 inch thick formed plastic, hollowed sandwich.
- D. Cant Strips: Premolded composition material.
- E. Counterflashings: As recommended by membrane and protection board manufacturer.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
- D. Verify items that penetrate surfaces to receive waterproofing are securely installed.

**3.02 PREPARATION**

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

- C. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- D. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

### **3.03 INSTALLATION**

- A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.
- B. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.
- C. At joints and cracks less than 1/2 inch in width including joints between horizontal and vertical surfaces, apply 12 inch wide strip of joint cover sheet.
- D. At joints from 1/2 inch to 1 inch in width, loop joint cover sheet down into joint between 1-1/4 inch to 1-3/4 inch, and extend sheet at least 6 inches on either side of expansion joint.
- E. Apply extra thickness of waterproofing material at corners, intersections, and angles.
- F. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
- G. Seal membrane and flashings to adjoining surfaces.

### **3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD**

- A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward, and scribe and cut boards around projections, penetrations, and interruptions.
- B. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

### **3.05 FIELD QUALITY CONTROL**

- A. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.
  - 1. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.
  - 2. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
  - 3. When area is proven watertight, drain water and remove dam.

### **3.06 PROTECTION**

**END OF SECTION**

## **SECTION 072100 THERMAL INSULATION**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Board insulation at cavity wall construction, perimeter foundation wall, and underside of floor slabs.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Field-applied termiticide for concrete slabs and foundations.
- B. Section 042723 - Cavity Wall Unit Masonry: Masonry walls enclosing insulation.
- C. Section 061000 - Rough Carpentry: Supporting construction for batt insulation.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2019.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C 2019a.
- E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2019.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

#### **1.05 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

#### **2.02 APPLICATIONS**

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) carbon black board.
- D. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

#### **2.03 FOAM BOARD INSULATION MATERIALS**

- A. Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. R-value; 1 inch of material at 72 degrees F: 5, minimum.
  - 4. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
  - 5. Board Edges: Square.

6. Water Absorption, Maximum: 0.3 percent, by volume.
7. Manufacturers:
  - a. Dow Chemical Co: [www.dow.com](http://www.dow.com).
  - b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: [www.ocbuildingspec.com](http://www.ocbuildingspec.com).
  - c. Substitutions: See Section 016000 - Product Requirements.
- B. Extruded Polystyrene (XPS) Cavity Wall Insulation Board: Complies with ASTM C578, and manufactured using carbon black technology.
  1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
  2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
  4. Board Size: 15-3/4 inch by 96 inch.
  5. Board Thickness: 1-3/4 inch.
  6. Board Edges: Square.

## **2.04 BATT INSULATION MATERIALS**

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
  1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
  2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
  4. Formaldehyde Content: Zero.
  5. Facing: Aluminum foil, flame spread 25 rated; one side.
  6. Manufacturers:
    - a. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  7. Substitutions: See Section 016000 - Product Requirements.

## **2.05 ACCESSORIES**

- A. Interior Vapor Retarder: Modified polyethylene/polyacrylate (PE/PA) film reinforced with polyethylene terephthalate (PET) fibers, 12 mils, 0.012 inch thick.
  1. Width: 4.9 feet.
- B. Tape joints of rigid insulation in accordance with roofing and insulation manufacturers' instructions.
- C. Nails or Staples: Steel wire; electroplated or galvanized; type and size to suit application.
- D. Wire Mesh: Galvanized steel, hexagonal wire mesh.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### **3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER**

- A. Install boards horizontally on foundation perimeter.
  1. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### **3.03 BOARD INSTALLATION AT CAVITY WALLS**

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.



- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

#### **3.04 BOARD INSTALLATION UNDER CONCRETE SLABS**

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

#### **3.05 BATT INSTALLATION**

- A. Install insulation and vapor retarder in accordance with manufacturer's instructions.
- B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

#### **3.06 PROTECTION**

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

## **SECTION 072500 WEATHER BARRIERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

#### **1.02 REFERENCE STANDARDS**

- A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.

#### **1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation.

#### **1.04 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

### **PART 2 PRODUCTS**

#### **2.01 WEATHER BARRIER ASSEMBLIES**

- A. Air Barrier:
  - 1. On outside surface of sheathing of exterior walls use air barrier coating, fluid applied type.

#### **2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)**

- A. Air Barrier Coating:
  - 1. Dry Film Thickness (DFT): 10 mil, 0.010 inch, minimum.
  - 2. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
  - 3. Water Vapor Permeance: 18 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure B (Water Method) at 73.4 degrees F.
  - 4. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to four months of weather exposure after application.
  - 5. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
  - 6. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  - 7. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
  - 8. Sealants, Tapes and Accessories: As recommended by coating manufacturer.

#### **2.03 ACCESSORIES**

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Thinners and Cleaners: As recommended by material manufacturer.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept the work of this section.

#### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Coatings:
  - 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
  - 2. Use flashing to seal to adjacent construction and to bridge joints.
- D. Openings and Penetrations in Exterior Weather Barriers:
  - 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
  - 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with at least 4 inches wide; do not seal sill flange.
  - 3. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
  - 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather 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 weather barrier surface.

### **3.04 FIELD QUALITY CONTROL**

- A. Do not cover installed weather barriers until required inspections have been completed.

### **3.05 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**

## **SECTION 074213 METAL WALL PANELS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Manufactured metal panels for walls and soffits, with related flashings and accessory components.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 072500 - Weather Barriers: Weather barrier under wall panels.
- B. Section 092116 - Gypsum Board Assemblies: Wall panel substrate.

#### **1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, methods of anchorage.
- C. Samples: Submit one samples of wall panel, 12 inch by 12 inch in size illustrating finish color, sheen, and texture.

#### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in installing the products specified in this section with minimum three years of documented experience.

#### **1.05 MOCK-UP**

- A. Construct mock-up, 8 feet long by 4 feet wide; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, related insulation in mock-up.
- B. Locate where directed.
- C. Mock-up may remain as part of the Work.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off ground and protected from weather. Prevent twisting, bending, or abrasion, and provide ventilation to stored materials. Slope metal sheets to ensure drainage.

#### **1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after the Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Basis of Design- Wall Panels: Metal Sales T10-D, 36"

#### **2.02 MANUFACTURED METAL PANELS**

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
  - 1. Provide exterior panels and subgirt framing assembly.
  - 2. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall.
  - 3. Maximum Allowable Deflection of Panel: 1/90 of span.
  - 4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.

5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
  7. Corners: Factory-fabricated in one continuous piece with minimum 18 inch returns.
- B. Exterior Panels: MP-1
1. Profile: Metal Sales T10-D.
  2. Material: Precoated steel sheet, 22 gage, 0.0299 inch minimum thickness.
  3. Panel Width: 36"
  4. Rib Height: 1-1/2"
  5. Color: As selected by Architect from manufacturer's full line.
- C. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- D. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles. Provide trim to cover back-up framing where occurs- coordinate with drawings.
- E. Anchors: Galvanized steel or Stainless steel.

## **2.03 MATERIALS**

- A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

## **2.04 FINISHES**

- A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

## **2.05 ACCESSORIES**

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- B. Concealed Sealants: Non-curing butyl sealant or tape sealant.
- C. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.
- D. Touch-up Paint: As recommended by panel manufacturer.
- E. U-edging for PM-1 & PM-2: Type 402 U-edging; 1/8" opening x 1" width; 18 gauge
- F. Bituminous Paint: Asphalt base.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that building framing members are ready to receive panels.
- B. Verify that weather barrier has been installed over substrate completely and correctly.

### **3.02 PREPARATION**

### **3.03 INSTALLATION**

- A. Install panels on walls in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.
- D. Use concealed fasteners unless otherwise approved by Architect.

### **3.04 TOLERANCES**

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch.

### **3.05 CLEANING**

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

**END OF SECTION**

**SECTION 075323**  
**ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING (EPDM) - FIRESTONE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. EPDM membrane roofing system, including all components specified.
- B. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at <http://manual.fsbp.com>.
- C. Commencement of work by Contractor shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.
- B. Section 076200 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

**1.03 REFERENCE STANDARDS**

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- B. ASTM C209 - Standard Test Methods for Cellulosic Fiber Insulating Board 2020.
- C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.
- D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board 2021.
- E. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics 2016.
- F. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics 2020.
- G. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2016.
- H. ASTM D6163/D6163M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements 2016.
- I. PS 20 - American Softwood Lumber Standard 2020.
- J. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems 2011.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Pre-Installation Conference: Before start of roofing work, Contractor shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
  - 1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
  - 2. Notify Architect well in advance of meeting.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
    - a. Technical data sheet for each insulation type.
    - b. Technical data sheet for each type of metal edging.

- C. Shop Drawings: Provide:
  - 1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.
  - 2. For tapered insulation, provide project-specific layout and dimensions for each board.
- D. Specimen Warranty: Submit prior to starting work.
- E. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications.
- F. Executed Warranty.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Roofing installer shall have the following:
  - 1. Current approval, license, or authorization as applicator by the manufacturer.
  - 2. At least five years experience in installing specified system.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

#### 1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- C. Warranty: Limited 20 Year Warranty covering membrane, roof insulation, and other indicated components of the system, for the term indicated.
  - 1. Limit of Liability: No dollar limitation.
  - 2. Scope of Coverage: Repair leaks in the roofing system caused by:
    - a. Ordinary wear and tear of the elements.
    - b. Manufacturing defect in brand materials.
    - c. Defective workmanship used to install these materials.
    - d. **Damage due to winds up to 90 mph.**
  - 3. Not Covered:
    - a. **Damage due to winds in excess of 90 mph.**
    - b. Damage due hurricanes or tornadoes.
    - c. Hail.
    - d. Intentional damage.
    - e. Unintentional damage due to normal rooftop inspections, maintenance, or service.
- D. **Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, roof pavers, for the following warranty period:**
  - 1. **Warranty Period: Two (2) years from Date of Substantial Completion.**
- E. Comply with Manufacturer's requirements where patching the existing roof to maintain warranty at existing roof areas.
- F. **Metal Roof Edging: Firestone full-system warranty for roof edge system, covering blow-off from winds up to 90 mph.**
- G. Metal Roof Edging with Exposed Decorative Fascia: Provide 20 year warranty for painted finish covering color fade, chalk, and film integrity.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Acceptable Manufacturer - Roofing System: Basis of Design: Firestone Building Products LLC, Carmel, IN: [www.firestonebpc.com](http://www.firestonebpc.com).



1. Roofing systems manufactured by others are acceptable provided the roofing system is completely equivalent in materials and warranty conditions and the manufacturer meets the following qualifications:
  - a. Specializing in manufacturing the roofing system to be provided.
  - b. Other manufacturers desiring approval shall submit requests to the Architect. Requests shall include PART 2- Products to show compliance with these specifications.
  - c. Roofing systems manufactured by the companies listed below are acceptable provided they are completely equivalent in materials and warranty conditions:
    - 1) Carlisle Syntec Systems.
    - 2) Versico Roofing Systems.
- B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.
- C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
  1. Metal roof edging products by other manufacturers are not acceptable.
  2. ~~Field- or shop-fabricated metal roof edgings are not acceptable.~~
- D. Substitutions: See Section 016000 - Product Requirements.
  1. Submit evidence that the proposed substitution complies with the specified requirements.

## 2.02 ROOFING SYSTEM DESCRIPTION

- A. Roofing System: Ethylene-propylene-diene-monomer (EPDM) single-ply membrane.
  1. Membrane Attachment: Fully adhered.
  2. Warranty: Full system warranty; Firestone 20 year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
  3. Comply with applicable local building code requirements.
  4. ***FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals' markings.***
    - a. ***Fire/Windstorm Classification: Class 1A-90.***
- B. Roofing System Components: Listed in order from the top of the roof down:
  1. Membrane: Thickness as specified.
  2. Insulation Cover Board: High density polyisocyanurate; mechanically attached
  3. Insulation:
    - a. Maximum Board Thickness: 3 inches; use as many layers as necessary; stagger joints in adjacent layers.
    - b. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on top.
    - c. R-value: R-30, minimum roof insulation at roof drains.
    - d. Top Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
    - e. Bottom Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
    - f. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.
  4. ***Vapor Retarder: One layer SBS modified bitumen base sheet; cold adhesive attached.***

## 2.03 EPDM MEMBRANE MATERIALS

- A. Roofing and Flashing Membrane: Black, cured synthetic single-ply membrane composed of ethylene propylene diene terpolymer (EPDM) with the following properties:
  1. Thickness: 0.060 inch.
  2. Sheet Width: Provide the widest available sheets to minimize field seaming.
- B. Flashing Membrane: Self-curing, non-reinforced membrane composed of nonvulcanized EPDM rubber, complying with ASTM D4811 Type II, and with the following properties:
- C. Self-Adhesive Flashing Membrane: Semi-cured 45 mil EPDM membrane laminated to 35 mil EPDM tape adhesive; QuickSeam Flashing by Firestone.

- D. Pre-Molded Pipe Flashings: EPDM, molded for quick adaptation to different sized pipes; Firestone EPDM Pipe Flashing.
- E. Self-Adhesive Lap Splice Tape: 35 mil EPDM-based, formulated for compatibility with EPDM membrane and high-solids primer; QuickSeam Splice Tape by Firestone.
- F. Splice Adhesive: Synthetic polymer-based, formulated for compatibility with EPDM membrane and metal surfaces; SA-1065 Splice Adhesive by Firestone.
- G. Bonding Adhesive: Neoprene-based, formulated for compatibility with EPDM membrane and wide variety of substrate materials, including masonry, wood, and insulation facings; Bonding Adhesive BA-2004 by Firestone.
- H. Adhesive Primer: Synthetic rubber based primer formulated for compatibility with EPDM membrane and tape adhesive; QuickPrime Plus by Firestone.
- I. Seam Edge Treatment: EPDM rubber-based sealant, formulated for sealing exposed edges of membrane at seams; Lap Sealant HS by Firestone.
- J. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.
- K. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed; Water Block Seal by Firestone.
- L. Metal Plates and Strips Used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria.
- M. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick; Firestone Termination Bar by Firestone.

#### **2.04 VAPOR RETARDER MATERIALS**

- A. ***Base Sheet: SBS polymer-modified bitumen sheet, complying with ASTM D6163/D6163M, Type I, Grade S, with glass fiber reinforcing fabric, formulated for hot asphalt and cold adhesive application to substrate and cap sheet; Firestone SBS Base.***

#### **2.05 ROOF INSULATION AND COVER BOARDS**

- A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C1289 Type II Class 1, with the following additional characteristics:
  - 1. Thickness: To meet R-30, minimum (See Drawings).
  - 2. Size: 48 inches by 96 inches, nominal.
    - a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
  - 3. Compressive Strength: 20 psi when tested in accordance with ASTM C1289.
  - 4. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
  - 5. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
- B. High Density Polyisocyanurate Cover Board: Non-combustible, water resistant, high density closed cell polyisocyanurate core with coated glass mat facers, with the following characteristics:
  - 1. Basis of Design: Firestone ISOGARD HD
  - 2. Size: 48 inches by 96 inches, nominal.
  - 3. Thickness: 1/2 inch.
  - 4. Thermal Value: R-value of 2.5, when tested in accordance with ASTM C518 and ASTM C177.
  - 5. Surface Water Absorption: 3 percent, maximum, when tested in accordance with ASTM C209.
  - 6. Compressive Strength: 120 psi, when tested in accordance with ASTM D1621.
  - 7. Density: 5 pcf, when tested in accordance with ASTM D1622/D1622M.
  - 8. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
  - 9. Mold Growth Resistance: Passing ASTM D3273.

#### **2.06 METAL ACCESSORIES**

- A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners;

mounted to roof edge nailer.

1. Wind Performance:
  - a. Membrane Pull-Off Resistance: 100 lbs/ft, minimum, when tested in accordance with ANSI/SPRI/FM 4435/ES-1 Test Method RE-1, current edition.
  - b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 Test Method RE-2, current edition.
  - c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.
2. Fascia Face Height: 5 inches.
3. Edge Member Height Above Nailers: 1-1/4 inches.
4. Length: 144 inches.
5. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
6. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
7. Anchor Bar Cleat: 20 gage, 0.036 inch G90 coated commercial type galvanized steel with pre-punched holes.
8. Curved Applications: Factory modified.
9. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
10. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch long legs on corner pieces.
11. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings. BY ROOF MANUFACTURER.

## **2.07 ACCESSORY MATERIALS**

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
  1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
  2. Thickness: Same as thickness of roof insulation.

## **PART 3 INSTALLATION**

### **3.01 GENERAL**

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
  1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.

2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
  3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

### **3.02 EXAMINATION**

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

### **3.03 PREPARATION**

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

### **3.04 INSULATION AND COVER BOARD INSTALLATION**

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- C. Lay roof insulation in courses parallel to roof edges.
- D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.
- E. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by membrane manufacturer.

### **3.05 SINGLE-PLY MEMBRANE INSTALLATION**

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane adhered to the substrate, with edge securement as specified.
- E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.
- F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as

recommended by roofing manufacturer.

1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

### **3.06 FLASHING AND ACCESSORIES INSTALLATION**

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
  1. Follow roofing manufacturer's instructions.
  2. Remove protective plastic surface film immediately before installation.
  3. Install water block sealant under the membrane anchorage leg.
  4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
  5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
  6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
  7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.
  1. Use the longest practical flashing pieces.
  2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
  3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
  4. Provide termination directly to the vertical substrate as shown on roof drawings.
- D. Roof Drains:
  1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
  2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.
  3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
  4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
  5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
- E. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
  1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
  2. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a standard curb with flashing.
  3. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

### **3.07 FINISHING AND WALKWAY INSTALLATION**

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

1. Do not install walkway pads within 10 feet of any roof edge or perimeter -- these areas require loose-laid pavers as walking surfaces.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.
  1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
  2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

### **3.08 FIELD QUALITY CONTROL**

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- B. Perform all corrections necessary for issuance of warranty.

### **3.09 CLEANING**

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

### **3.10 PROTECTION**

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

**END OF SECTION**

**SECTION 076200  
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. Accessories.
- D. Precast concrete splash pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.
- B. Section 079200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2017a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 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 013000 - 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 one samples 12x12 inch in size illustrating metal finish color.

**1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with CDA A4050, SMACNA (ASMM), CDA A4050, and SMACNA (ASMM) 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. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

**PART 2 PRODUCTS**

**2.01 SHEET MATERIALS \*COLOR TO MATCH METAL PANEL COLOR- COLOR VARIES WITH LOCATION\***

- A. Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage (0.0239 inch) thick base metal.
- B. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gage (0.032 inch) thick; plain finish shop pre-coated with modified silicone coating.
  - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.

## **2.02 ACCESSORIES**

- A. Fasteners: Galvanized steel , with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Protective Backing Paint: Zinc molybdate alkyd.
- D. Sealant to be Concealed in Completed Work: Non-curing butyl sealant.
- E. Sealant to be Exposed in Completed Work: ASTM C920; elastomeric sealant, 100 percent silicone with minimum movement capability of plus/minus 25 percent and recommended by manufacturer for substrates to be sealed; clear.
- F. Sealant: specified in Section 07 9005.
- G. Plastic Cement: ASTM D4586, Type I.

## **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.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

## **2.04 GUTTER AND DOWNSPOUT FABRICATION**

- A. Downspouts: Rectangular profile. Color to match roof assembly.
- B. Accessories: Profiled to suit gutters and downspouts.
  - 1. Anchorage Devices: In accordance with SMACNA requirements.
  - 2. Gutter Supports: Brackets.
  - 3. Downspout Supports: Brackets.
- C. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.
- D. Seal metal joints.

## **2.05 ACCESSORIES**

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

### **3.03 INSTALLATION**



- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.
- E. Secure gutters and downspouts in place with concealed fasteners.
- F. Connect downspouts to downspout boots, and seal connection watertight.
- G. Set splash pads under downspouts.

#### **3.04 FIELD QUALITY CONTROL**

- A. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**END OF SECTION**

## **SECTION 078400 FIRESTOPPING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- D. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.
- E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).
- F. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- G. UL (FRD) - Fire Resistance Directory Current Edition.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

#### **1.05 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

#### **1.06 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Manufacturers:
  - 1. A/D Fire Protection Systems Inc.: [www.adfire.com](http://www.adfire.com).
  - 2. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
  - 3. Hilti, Inc: [www.us.hilti.com/#sle](http://www.us.hilti.com/#sle).
  - 4. Nelson FireStop Products: [www.nelsonfirestop.com](http://www.nelsonfirestop.com).
  - 5. Specified Technologies, Inc.: [www.stifirestop.com](http://www.stifirestop.com).
- B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- C. Fire Ratings: Refer to drawings for required systems and ratings.

#### **2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
- B. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
- C. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

## **2.03 FIRESTOPPING FOR FLOOR-TO-FLOOR, WALL-TO-FLOOR, AND WALL-TO-WALL JOINTS**

- A. Gypsum Board Walls:
  - 1. Wall to Wall Joints That Have Movement Capabilities (Dynamic):
    - a. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

## **2.04 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS**

- A. Blank Openings:
  - 1. 1 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.
- B. Penetrations By:
  - 1. Multiple Penetrations in Large Openings:
    - a. 1 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
    - b. 1 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
  - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 1 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
    - a. 1 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 4. Electrical Cables Not In Conduit:
    - a. 1 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
  - 5. Insulated Pipes:
    - a. 1 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.

## **2.05 FIRESTOPPING SYSTEMS**

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: See drawings for required systems and ratings.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

### **3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

### **3.03 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

### **3.04 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

### **3.05 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

## **SECTION 079005 JOINT SEALERS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Precompressed foam sealers.

#### **1.02 REFERENCE STANDARDS**

- A. ASTM C834 - Standard Specification for Latex Sealants 2017.
- B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2018.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- D. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

#### **1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with other sections referencing this section.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Samples: Submit two samples, 1/2 x 1/2 inch in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures.

#### **1.05 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

#### **1.06 WARRANTY**

- A. See Section 017800 - 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 which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Gunnable and Pourable Sealants:
  - 1. Adhesives Technology Corporation: [www.atc.ws](http://www.atc.ws).
  - 2. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  - 3. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 4. ARDEX Engineered Cements: [www.ardexamericas.com](http://www.ardexamericas.com).
  - 5. Dow Corning Corporation: [www.dowcorning.com](http://www.dowcorning.com).
  - 6. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - 7. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com](http://www.momentive.com).
  - 8. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 9. The QUIKRETE Companies: [www.quikrete.com](http://www.quikrete.com).
  - 10. Red Devil: [www.reddevil.com](http://www.reddevil.com).
  - 11. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
  - 12. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).
  - 13. Sika Corporation: [www.usa-sika.com](http://www.usa-sika.com).
  - 14. W.R. Meadows, Inc: [www.wrmeadows.com](http://www.wrmeadows.com).
  - 15. Substitutions: See Section 016000 - Product Requirements.
- B. Preformed Compressible Foam Sealers:
  - 1. EMSEAL Joint Systems, Ltd: [www.emseal.com](http://www.emseal.com).
  - 2. Sandell Manufacturing Company, Inc: [www.sandellmfg.com](http://www.sandellmfg.com).
  - 3. Dayton Superior Corporation: [www.daytonsuperior.com](http://www.daytonsuperior.com).
  - 4. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).

5. Substitutions: See Section 016000 - Product Requirements.

## 2.02 SEALANTS

- A. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25 minimum; Uses M, G, and A; single component.
1. Color: To be selected by Architect from manufacturer's standard range.
  2. Applications: Use for:
    - a. Control, expansion, and soft joints in masonry.
    - b. Joints between concrete and other materials.
    - c. Joints between metal frames and other materials.
    - d. Other exterior joints for which no other sealant is indicated.
- B. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
1. Applications: Use for:
    - a. Concealed sealant bead in sheet metal work.
    - b. Concealed sealant bead in siding overlaps.
- C. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, Type OP, Grade NF single component, paintable.
1. Color: To be selected by Architect from manufacturer's full range.
  2. Applications: Use for:
    - a. Interior wall and ceiling control joints.
    - b. Joints between door and window frames and wall surfaces.
    - c. Other interior joints for which no other type of sealant is indicated.
- D. Bathtub/Tile Sealant: White silicone; ASTM C920, Uses I, M and A; single component, mildew resistant.
1. Applications: Use for:
    - a. Joints between plumbing fixtures and floor and wall surfaces.
  2. Products:
    - a. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
    - b. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
    - c. Pecora Corporation; 898NST Sanitary Silicone Sealant - Class 50: [www.pecora.com](http://www.pecora.com).
    - d. Tremco Global Sealants; [\_\_\_\_]: [www.tremcosealants.com](http://www.tremcosealants.com).
    - e. Substitutions: See Section 016000 - Product Requirements.
- E. Acoustical Sealant for Concealed Locations:
1. Composition: Acrylic latex emulsion sealant.
  2. Applications: Use for concealed locations only:
    - a. Sealant bead between top stud runner and structure and between bottom stud track and floor.
  3. Products:
    - a. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
    - b. Pecora Corporation; AIS-919 Acoustical and Insulation Latex Sealant: [www.pecora.com](http://www.pecora.com).
    - c. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
    - d. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
    - e. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: [www.us.hilti.com](http://www.us.hilti.com).
    - f. Substitutions: See Section 016000 - Product Requirements.
- F. Polyurea Concrete Floor Joint Filler: Self-leveling, pourable, semi-rigid sealant intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Composition: Single or multi-part, 100 percent solids by weight.
  2. Hardness: 75, minimum, after 7 days, when tested in accordance with ASTM D2240 Shore A.

## 2.03 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

### **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. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Install bond breaker where joint backing is not used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- G. Tool joints concave.
- H. Concrete Floor Joint Filler: Install concrete floor joint filler per manufacturer's written instructions. After floor joint filler is fully cured, shave joint filler flush with top of concrete slab.

### **3.04 CLEANING**

- A. Clean adjacent soiled surfaces.

### **3.05 PROTECTION**

- A. Protect sealants until cured.

**END OF SECTION**

**SECTION 079513  
EXPANSION JOINT COVER ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Expansion joint cover assemblies for floor and wall surfaces.

**1.02 RELATED REQUIREMENTS**

- A. Section 042000 - Unit Masonry: Placement of joint cover assembly frames in masonry.
- B. Section 079200 - Joint Sealants: Sealing expansion and control joints using gunnable and pourable sealants.

**1.03 REFERENCE STANDARDS**

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles 2020.
- D. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- E. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
- C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.
- D. Samples: Submit two samples 6 inch long, illustrating profile, dimension, color, and finish selected.
- E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Expansion Joint Cover Assemblies:
  - 1. Architectural Art Mfg, Inc: [www.archart.com/#sle](http://www.archart.com/#sle).
  - 2. Construction Specialties, Inc: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  - 3. EMSEAL Joint Systems, Ltd: [www.emseal.com/#sle](http://www.emseal.com/#sle).
  - 4. Inpro: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 5. MM Systems Corp: [www.mmsystemscorp.com/#sle](http://www.mmsystemscorp.com/#sle).
  - 6. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 7. Pecora Corporation: [www.pecora.com/#sle](http://www.pecora.com/#sle).
  - 8. Watson Bowman Acme Corporation: [www.watsonbowmanacme.com/#sle](http://www.watsonbowmanacme.com/#sle).
  - 9. Substitutions: See Section 016000 - Product Requirements.

**2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS**

- A. Interior Floor Joints Subject to Thermal Movement:
  - 1. Manufacturers:
    - a. Balco, Inc; No-Bump Floor to Floor System, Aluminum (NBAF): [www.balcousa.com/#sle](http://www.balcousa.com/#sle).



- b. Construction Specialties, Inc; Allway Standard Metal Floor Covers: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  - c. Watson Bowman Acme Corporation; Wabo CorridorWrap Floor: [www.watsonbowmanacme.com/#sle](http://www.watsonbowmanacme.com/#sle).
  - d. Substitutions: See Section 016000 - Product Requirements.
- B. Interior Wall/Ceiling Joints Subject to Thermal Movement:
  - 1. Manufacturers:
    - a. Balco, Inc; Wall and Ceiling Snap-On Joint Cover (WD): [www.balcousa.com/#sle](http://www.balcousa.com/#sle).
    - b. Construction Specialties, Inc; Allway Standard Wall and Ceiling Covers: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.
- C. Interior Fire-Rated Wall/Ceiling/Floor Joints Subject to Thermal Movement:
  - 1. Manufacturers:
    - a. Construction Specialties, Inc; Fire Barriers: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
- D. Interior/Exterior Fire-Rated Wall Joints Subject to Thermal Movement:
  - 1. Manufacturers:
    - a. EMSEAL Joint Systems, Ltd; Emshield WFR2 System: [www.emseal.com/#sle](http://www.emseal.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- E. Exterior Wall Joints Subject to Thermal Movement:
  - 1. Manufacturers:
    - a. Balco, Inc; Exterior Wall, Elastomeric Face Seal System (FCWW): [www.balcousa.com/#sle](http://www.balcousa.com/#sle).
    - b. Construction Specialties, Inc; Exterior Wall Covers: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
    - c. EMSEAL Joint Systems, Ltd; BG System: [www.emseal.com/#sle](http://www.emseal.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.

## **2.03 EXPANSION JOINT COVER ASSEMBLIES**

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
  - 1. Joint Dimensions and Configurations: As indicated on drawings.
  - 2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
  - 3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
  - 4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.
  - 1. If floor covering is not indicated, obtain instructions from Architect before proceeding.
  - 2. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.
- C. Covers in Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.

## **2.04 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
  - 1. Exposed Finish Outdoors: Natural anodized.
  - 2. Exposed Finish at Floors: Mill finish or natural anodized.
  - 3. Exposed Finish at Walls and Ceilings: Natural anodized.
- B. Anchors and Fasteners: As recommended by cover manufacturer.
- C. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

## **2.05 ACCESSORIES**

- A. Resilient Fire Barrier: For use with metal expansion joint covers and elastomeric seals without use of mechanical fasteners, with fire rating in accordance with surrounding construction performance capabilities.
  - 1. Application: Roof.

2. Fire Resistance Rating: 3-hour, in accordance with ASTM E1966 and UL 2079.
3. Joint Opening: 3/8 inch, nominal.
4. Manufacturers:
  - a. Balco, Inc; Expansion Joint Fire Barrier, Floor/Roof - MetaBlock, 2 Hour (MBF2H):  
[www.balcousa.com/#sle](http://www.balcousa.com/#sle).

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

#### **3.02 INSTALLATION**

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Align work plumb and level, flush with adjacent surfaces.
- C. Rigidly anchor to substrate to prevent misalignment.

**END OF SECTION**

**SECTION 081113  
HOLLOW METAL DOORS AND FRAMES**

**1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Thermally insulated hollow metal doors with frames.
- E. Hollow metal borrowed lites glazing frames.

**1.02 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware.
- B. Section 088000 - Glazing: Glass for doors and borrowed lites.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2009.
- 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 2020.
- 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 2021.
- 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 C1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2011.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- J. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2007.
- K. See Section 013000 - Administrative Requirements, for submittal procedures.
- L. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

**1.04 QUALITY ASSURANCE**

- A. Maintain at project site copies of reference standards relating to installation of products specified.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

**PART 2 PRODUCTS**

- 1. De La Fontaine Inc: [www.delafontaine.com](http://www.delafontaine.com).

**2.02 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvannealed 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.
- 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
- 3. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### **2.03 HOLLOW METAL DOORS**

- A. Exterior Doors: Thermally insulated.
  - 1. Door Thickness: 1-3/4 inch, nominal.
  - 2. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness.
  - 3. Insulating Value: U-value of 0.50, when tested in accordance with ASTM C1363.
- B. Interior Doors, Non-Fire-Rated:
  - 1. Door Thickness: 1-3/4 inch, nominal.

### **2.04 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. General:
  - 1. Comply with the requirements of grade specified for corresponding door.
    - a. Frames for Wood Doors: Comply with frame requirements in accordance with ANSI/SDI A250.8 (SDI-100), Level 1, 18 gage, 0.042 inch, minimum thickness.
  - 2. Finish: Same as for door.
  - 3. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- C. Exterior Door Frames: Full profile/continuously welded type.
  - 1. Weatherstripping: Separate, see Section 087100.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
- E. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- F. Mullions for Pairs of Doors: Fixed, with profile similar to jambs.
- G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

### **2.05 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

### **2.06 ACCESSORIES**

- A. Glazing: As specified in Section 088000, factory installed.
- B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- C. 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.
- D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

### **2.07 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

### **2.08 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.

### **2.09 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
- B. Comply with glazing installation requirements of Section 088000.

**2.10 TOLERANCES**

- A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

**2.11 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

**2.12 SCHEDULE**

**END OF SECTION**

## **SECTION 081416 FLUSH WOOD DOORS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Flush wood doors; flush and flush glazed configuration; fire rated.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 4.0 2021.
- D. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2019.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Specimen warranty.
- E. Samples: Submit two samples of door veneer, 6 by 6 inch in size illustrating wood grain, stain color, and sheen.
- F. Manufacturer's Installation Instructions: Indicate special installation instructions.
- G. Warranty, executed in Owner's name.

#### **1.05 QUALITY ASSURANCE**

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

#### **1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:

1. Graham Wood Doors: [www.grahamdoors.com](http://www.grahamdoors.com).
2. VT Industries.

## **2.02 DOORS AND PANELS**

- A. Doors: Refer to drawings for locations and additional requirements.
  1. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  1. Provide solid core doors at each location.
  2. Wood veneer facing with factory transparent finish matching sample provided by Architect.

## **2.03 DOOR AND PANEL CORES**

## **2.04 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: Red oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

## **2.05 ACCESSORIES**

- A. Glazed Openings:
  1. Heat-Strengthened and Fully Tempered Glass: {rs#1}.
  2. Glazing: Single vision units, 1/4 inch glass.
  3. Tint: Clear.
- B. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Non-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge.

## **2.06 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  1. Provide solid blocks at lock edge for hardware reinforcement.
  2. Provide solid blocking for other throughbolted hardware.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.
- F. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  1. Transparent:
    - a. System - 1, Lacquer, Nitrocellulose.
    - b. Sheen: Flat.
- G. Factory finish doors in accordance with sample to be provided.

## **2.07 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

## **2.08 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.

- E. Coordinate installation of glazing.

#### **2.09 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

#### **2.10 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

#### **2.11 SCHEDULE**

- A. Refer to Door and Frame Schedule appended to this section.

**END OF SECTION**



**SECTION 083400  
SPECIAL FUNCTION DOORS**

**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 Aluminum-Framed Top-Hung Sliding Doors
- B. Related Sections:
  - 1. Section 08 14 16 – Flush Wood Door
  - 2. Section 08 13 16 – Aluminum Doors

**1.03 REFERENCES**

- A. ANSI – American National Standards Institute
  - 1. ANSI 156.18 Materials and Finishes
  - 2. ANSI A117.1 Specifications for making buildings and facilities usable by physically handicapped people.
- B. BHMA – Builders Hardware Manufacturers Association
- C. DHI – Door and Hardware Institute
- D. NFPA – National Fire Protection Association
  - 1. NFPA 80 – Fire Doors and Windows
  - 2. NFPA 101 – Life Safety code
  - 3. NFPA 105 – Smoke and Draft Control Door Assemblies
  - 4. NFPA 252 – Fire Tests of Doors Assemblies
- E. AWS – Architectural Woodwork Standards

**1.04 SUBMITTALS**

- A. Comply with Section 01 33 00 – Submittal Procedures
- B. Product Data: Submit manufacturer's product data, including installation instructions.

- C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, tolerances, materials, components, hardware, finish, options, and accessories. Shop Drawings to show required blocking by others.
- D. Samples: Submit manufacturer's samples of the following sliding door components:
  - 1. Door veneer or laminate sample.
  - 2. Aluminum Frame finish sample.
- E. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.
- F. Warranty Documentation: Submit manufacturer's standard warranty for complete system
- G. Test Reports: Submit acoustical reports or UL1784 as applicable.

#### **1.05 QUALITY ASSURANCE**

- A. Product Options: Drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and doors.
- B. Source: Obtain sliding aluminum framed doors and hardware from single source.
- C. Manufacturer's Qualifications: Manufacturer regularly engaged for past 5 years in manufacture of sliding doors similar to that specified.

#### **1.06 PERFORMANCE**

- A. Aluminum perimeter frames with integral acoustic seals at all door/frame interfaces
  - 1. Architect to verify frame thickness suitable for required application
- B. Soft-closing mechanism at both sides of door integrated with top track. Soft Closers tested to a minimum of 150,000 cycles.
- C. Concealed door guide.
- D. Manufacturer to 3<sup>rd</sup> party acoustical performance test data
- E. Manufacturer to submit 3<sup>rd</sup> party test data on air infiltration and/or smoke ratings as applicable

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Notify manufacturer immediately of any shipping damage.
- C. Storage and Handling Requirements:

1. Store and handle materials in accordance with manufacturer's instructions.
2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
3. Store materials in clean, dry area indoors.
4. Protect materials and finish during storage, handling, and installation to prevent damage.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. AD SYSTEMS 2201 100th St. SW, Everett, WA 98204 | Website:  
<http://specADsystems.com> | Phone: 425-740-6011 | [ADSystems.Estimating@allegion.com](mailto:ADSystems.Estimating@allegion.com)

### **2.02 INTERIOR SLIDING ALUMINUM-FRAMED DOORS AND PARTITIONS**

1. ExamSlide™ High Performance Barn (Sliding) Door System by AD Systems.
2. No Substitutions

- A. Specified Wall Thickness: See Drawings

- B. Frame Profiles: Extruded aluminum frame "wrap" frame with integral vertical jamb (stile pocket). Frames required to complete seal around door leaf. Gasketing required at all frame to door interfacing. Exposed gaskets at jamb to be silicone.

- C. Finish:

NOTE: Specify standard hardcoat (Kynar) finish in Light Sequin other custom (Kynar or other architectural paint) color option. Consult AD Systems for availability.

1. Standard: Painted Hardcoat (Kynar) Finish. Meets AAMA 2604 Standard Colors: Light Sequin 789G048.

- D. Door Leafs. All Doors to be factory machined for hardware including pilot and function holes. Leading edge of door to be fully finished.

NOTE: Specify material for doors or reference separate specification section for wood doors, wood stile and rail doors, aluminum doors, etc.

1. 1-3/4" Flush Wood Door: Reference Spec Section 08200 Wood Doors or other section as applicable. OR OPTION: Specify: [Solid Timber-Strand Core] [Solid Particle Core] <Insert veneer species, cut, stain or plastic laminate>.

- a. Optional Glazing: Monolithic clear tempered.
- b. Standard stile widths are 6" with a 10" bottom rail.

2. Other 1-3/4" Doors. Contact AD Systems.

- E. Door Components (Required):

NOTE: Specify required components. Delete components not required.

1. Single Top Track: Anodized finish aluminum track
  2. Valances: Extruded aluminum with integral end caps
    - a. Standard square valance.
  3. Top Rollers: tandem nylon roller sized to match door weight
  4. Concealed Floor Guide: Integral Jamb floor guide by AD Systems
  5. Soft-Closers: Soft-closing dampeners at [one] both sides of door leaf. Demonstrate soft closers as tested to 150k cycles
  6. Handles:
    - a. Standard Ladder Pull: 16" long x 1" diameter. Finish: US32D Satin Stainless Steel.
- F. Door Locks (Optional):

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.
- B. Verify dimensions of wall openings.
- C. Examine surfaces to receive top and bottom guide.
- D. Notify Architect of conditions that would adversely affect installation or subsequent use of sliding doors.
- E. Do not begin installation until unacceptable conditions are corrected.
- F. Base of door side to be flush or minimal. Rubber Base acceptable.

### **3.02 INSTALLATION**

- A. Install sliding doors in accordance with manufacturer's instructions at locations indicated on the Drawings.
- B. Install sliding doors plumb, level, square, and in proper alignment.
- C. Install sliding doors to close against walls without gaps
- D. Install sliding doors to open and close smoothly.
- E. Anchor sliding doors securely in place to supports. Required: Fire treated 2 x 6 blocking required full length of track.

### **3.03      ADJUSTING**

- A. Adjust sliding doors for proper operation in accordance with manufacturer's instructions.
- B. Adjust sliding doors to operate smoothly without binding.
- C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

### **3.04      CLEANING**

- A. Clean sliding doors promptly after installation in accordance with manufacturer's instructions.
- B. Do not use harsh cleaning materials or methods that could damage materials or finish.

### **3.05      PROTECTION**

- A. Protect installed sliding doors from damage during construction.

**END OF SECTION**

**SECTION 083613  
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 055000 - Metal Fabrications: Steel channel opening frame.
- B. Section 061000 - Rough Carpentry: Rough wood framing for door opening.
- C. Section 079005 - Joint Sealers: Perimeter sealant and backup materials.
- D. Section 087100 - Door Hardware: Lock cylinders.
- E. Section 260583 - Wiring Connections.

**1.03 REFERENCE STANDARDS**

- A. ANSI A135.4 - Basic Hardboard 2012 (R2020).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.
- F. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- G. ASTM C1036 - Standard Specification for Flat Glass 2021.
- H. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- I. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors 2011.
- J. NEMA MG 1 - Motors and Generators 2018.
- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 013000 - 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.
- D. Samples: Submit two panel finish samples, 12x12 inch in size, illustrating color and finish.
- E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- F. Operation Data: Include normal operation, troubleshooting, and adjusting.
- G. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of experience.

## **1.06 WARRANTY**

- A. See Section 017800 - Closeout Submittals for warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for electric motor and transmission.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Sectional Doors:
  - 1. C.H.I. Overhead Doors: [www.chiohd.com](http://www.chiohd.com).
  - 2. Clopay Building Products: [www.clopaydoor.com/#sle](http://www.clopaydoor.com/#sle).
  - 3. Clopay Corporation: [www.clopaydoor.com](http://www.clopaydoor.com).
  - 4. Wayne-Dalton, a Division of Overhead Door Corporation: [www.wayne-dalton.com](http://www.wayne-dalton.com).
  - 5. Substitutions: See Section 016000 - Product Requirements.

### **2.02 STEEL DOOR COMPONENTS**

- A. Steel Doors: Flush steel, insulated; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
  - 1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
  - 2. Door Nominal Thickness: 2 inches thick.
  - 3. Exterior Finish: Factory finished with acrylic baked enamel; color as selected by Architect.
  - 4. Interior Finish: Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
  - 5. Glazed Lights: four glazed lights per panel, two rows; set in place with resilient glazing channel.
- B. Door Panels: Steel construction; outer steel sheet of 20 gage, 0.0359 inch minimum thickness, flat profile; inner steel sheet of 20 gage, 0.0359 inch minimum thickness, flat profile; core reinforcement sheet steel roll formed to channel shape, rabbeted weather joints at meeting rails; polyurethane insulation.
- C. Glazing: Annealed float glass; insulated; clear; 1/2 inch thick.

### **2.03 DOOR COMPONENTS**

- A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 3 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 stainless 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 stainless 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.

- B. Float Glass: Provide float glass glazing, unless noted otherwise.
- C. Insulation: Foamed-in-place polyurethane, bonded to facing.

## **2.05 ELECTRICAL OPERATION**

- A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by a testing agency acceptable to authorities having jurisdiction or UL.
- B. Electrical Characteristics:
  - 1. Mounting: Center mounted draw bar assembly.
  - 2. 1/3 hp; [ ] rated load amperes; manually operable in case of power failure, transit speed of 12 inches per second.
  - 3. 120 volts, single phase, 60 Hz.
- C. Motor: NEMA MG 1, Type 1.
- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
- E. 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.
- F. Disconnect Switch: Factory mount disconnect switch in control panel.
- G. Electric Operator: trolley style, adjustable safety friction clutch; brake system actuated by independent voltage solenoid controlled by motor starter; enclosed gear driven limit switch; enclosed magnetic cross line reversing starter; mounting brackets and hardware.
- H. Safety Edge: At bottom of door panel, full width; electro-mechanical sensitized type, wired to stop door upon striking object; hollow neoprene covered to provide weatherstrip seal.
  - 1. Manufacturers:
    - a. Miller Edge, Inc: [www.MillerEdge.com/#sle](http://www.MillerEdge.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- I. Control Station: Standard three button (open-close-stop) momentary type control for each electric operator.
  - 1. 24 volt circuit.
  - 2. Surface mounted.
  - 3. Locate at inside door jamb.
- J. Provide interconnection to security system.
- K. Radio Control Antenna Detector:
- L. Hand Held Transmitter: Digital control, resettable. 2 per operator.

## **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.
- B. Apply primer to wood frame.

### **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.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

#### **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**

**SECTION 084313**  
**ALUMINUM-FRAMED STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.
- D. Door hardware.
- E. Perimeter sealant.

**1.02 RELATED REQUIREMENTS**

- A. Section 087100 - Door Hardware: Hardware items other than specified in this section.
- B. Section 088000 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2014 (2015 Errata).
- D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2020.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2016).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit one samples 12 x 12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.
- E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

- F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- H. Designer's Qualification Statement.
- I. Manufacturer's Qualification Statement.
- J. Installer's Qualification Statement.
- K. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## **1.06 QUALITY ASSURANCE**

- A. ***Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.***
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

## **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

## **1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

## **1.09 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

# **PART 2 PRODUCTS**

## **2.01 MANUFACTURERS**

## **2.02 MANUFACTURERS**

- A. Aluminum-Framed Storefront and Doors:
  - 1. Kawneer North America: [www.kawneer.com](http://www.kawneer.com).
  - 2. Manko Window Systems, Inc: [www.mankowindows.com](http://www.mankowindows.com).
  - 3. Oldcastle BuildingEnvelope: [www.oldcastlebe.com/#sle](http://www.oldcastlebe.com/#sle).
  - 4. Tubelite, Inc: [www.tubeliteinc.com](http://www.tubeliteinc.com).
  - 5. Substitutions: See Section 016000 - Product Requirements.

## **2.03 STOREFRONT**

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Glazing Position: Front-set.
  - 2. Finish: Class I color anodized.
    - a. Factory finish all surfaces that will be exposed in completed assemblies.
    - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  - 3. Finish Color: Dark bronze.
  - 4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.

5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
  7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
  8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements:
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
    - a. Design Wind Loads: Comply with requirements of ASCE 7.
    - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
  2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
  3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.

#### **2.04 COMPONENTS**

1. Framing members for interior applications need not be thermally broken.
  2. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
- B. Glazing: As specified in Section 088000.

#### **2.05 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Fasteners: Stainless steel.
- D. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.
- E. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch minimum thickness.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- G. Sealant for Setting Thresholds: Non-curing butyl type.
- H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- I. Glazing Accessories: As specified in Section 088000.

#### **2.06 FINISHES**

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

#### **2.07 HARDWARE**

- A. For each door, include weatherstripping, sill sweep strip, and threshold.
- B. Other Door Hardware: As specified in Section 087100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.
- D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

- E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

#### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Set thresholds in bed of sealant and secure.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

#### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

#### **3.04 ADJUSTING**

- A. Adjust operating hardware and sash for smooth operation.

#### **3.05 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

#### **3.06 PROTECTION**

- A. Protect installed products from damage until Date of Substantial Completion.

**END OF SECTION**

## **SECTION 087100 DOOR HARDWARE**

### **PART 1 - GENERAL**

#### **1.1 CONDITIONS**

- A. Conditions of the contract (General and Supplementary Conditions) and Division One General Requirements, govern the work of this section.
- B. This section includes all material, and related service necessary to furnish all finish hardware indicated on the drawings, or specified herein.
- C. Furnish UL listed hardware for all labeled and 20 min. openings in conformance with the requirements for the class of opening scheduled. Underwriters' requirements shall have precedence over specification where conflicts exist.
- D. All work shall be in accordance with all applicable state and local building codes. Code requirements shall have precedence over this specification where conflicts exist.

#### **1.2 WORK INCLUDED**

- A. This section includes the following:
  - 1. Furnish door hardware (for hollow metal, wood and aluminum doors) specified herein, listed in the hardware schedule, and/or required by the drawings.
  - 2. Cylinders for Aluminum Doors
  - 3. Thresholds and Weather-stripping (Aluminum frame seals to be provided by aluminum door supplier)
  - 4. Electro-Mechanical Devices
  - 5. Access Control components and or systems specified within this section.
- B. Where items of hardware are not definitely or correctly specified and is required for the intended service, such omission, error or other discrepancy should be directed to the Architect prior to the bid date for clarification by addendum. Otherwise furnish such items in the type and quantity established by this specification for the appropriate service intended.

#### **1.3 RELATED WORK IN OTHER SECTIONS**

- A. This section includes coordination with related work in the following sections:
  - 1. Division 6 Section "Finish Carpentry".
  - 2. Division 6 Section "Cabinet Hardware"
  - 3. Division 8 Section "Hollow Metal Doors and Frames".
  - 4. Division 8 Section "Wood Doors"
  - 5. Division 8 Section "Aluminum Entrances and Storefronts"
  - 6. Division 28 Sections "Electrical".

#### **1.4 REFERENCES**

- A. Publications of agencies and organizations listed below form a part of this specification section to the extent referenced.
  - 1. DHI - Recommended Locations for Builders' Hardware.
  - 2. NFPA 80 - Standards for Fire Doors and Windows.
  - 3. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
  - 4. UL - Building Material Directory.
  - 5. DHI - Door and Hardware Institute
  - 6. WHI - Warnock Hersey
  - 7. BHMA - Builders Hardware Manufacturers Association
  - 8. ANSI - American National Standards Institute
  - 9. ANSI ICC500 - Standard for the Design and Construction of Storm Shelters
  - 10. IBC 2015 - International Building Code 2015 Edition (as amended by local building code)

## 1.5 SUBMITTALS

- A. Within ten days after award of contract, submit detailed hardware schedule in quantities as required by Division 1 - General Conditions.
- B. Schedule format shall be consistent with recommendations for a vertical format as set forth in the Door & Hardware Institute's (DHI) publication "Sequence and Format for the Hardware Schedule". Hardware sets shall be consolidated to group multiple door openings which share similar hardware requirements. Schedule shall include the following information:
  - 1. Door number, location, size, handing, and rating.
  - 2. Door and frame material, handing.
  - 3. Degree of swing.
  - 4. Manufacturer
  - 5. Product name and catalog number
  - 6. Function, type and style
  - 7. Size and finish of each item
  - 8. Mounting heights
  - 9. Explanation of abbreviations, symbols, etc.
  - 10. Numerical door index, indicating the hardware set/ group number for each door.
- C. When universal type door closers are to be provided, the schedule shall indicate the application method to be used for installation at each door: (regular arm, parallel arm, or top jamb).
- D. The schedule will be prepared under the direct supervision of a certified Architectural Hardware Consultant (AHC), or certified Door Hardware Consultant (DHC) employed by the hardware distributor. The hardware schedule shall be signed and embossed or stamped with the DHI certification seal of the supervising AHC or DHC. The supervising AHC or DHC shall attend any meetings related to the project when requested by the architect.
- E. Check the specified hardware for suitability and adaptability to the details and surrounding conditions.
- F. Review drawings from related trades as required to verify compatibility with specified hardware. Indicate unsuitable or incompatible items, and proposed substitutions in the hardware schedule.
- G. Provide documentation for all hardware to be furnished on labeled fire doors indicating compliance with positive pressure fire testing UL 10C.
- H. Furnish manufacturers' catalog data for each item of hardware in quantities as required by Division 1 - General Conditions.
- I. Submit a sample of each type of hardware requested by the architect. Samples shall be of the same finish, style, and function as specified herein. Tag each sample with its permanent location so that it may be used in the final work.
- J. Furnish with first submittal, a list of required lead times for all hardware items.
- K. After final approved schedule is returned, transmit corrected copies for distribution and field use in quantities as required by Division 1 - General Conditions.
- L. Furnish approved hardware schedules, template lists, and pertinent templates as requested by related trades.
- M. Furnish necessary diagrams, schematics, voltage and amperage requirements for all electro-mechanical devices or systems as required by related trades. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.
- N. After receipt of approved hardware schedule, Hardware supplier shall initiate a meeting including the owner's representative to determine keying requirements. Upon completion of initial key meeting, hardware supplier shall prepare a proposed key schedule with symbols and abbreviations as set forth in the door and hardware institute's publication "Keying Procedures, Systems, and Nomenclature". Submit copies of owner approved key schedule for review and

field use in quantities as required by Division 1 – General Conditions. Wiring diagrams shall be included in final submittals transmitted for distribution of field use.

## **1.6 QUALITY ASSURANCE**

- A. Manufacturers and model numbers listed are to establish a standard of function and quality. Similar items by approved manufacturers that are equal in design, function, and quality, may be considered for prior approval of the architect, provided the required data and physical samples are submitted for approval as set forth in Division One General Requirements.
- B. Where indicated in this specification, products shall be independently certified by ANSI for compliance with relevant ANSI/BHMA standards A156.1 - A156.36 – Standards for Hardware and Specialties. All products shall meet or exceed certification requirements for the respective grade indicated within this specification. Supplier shall provide evidence of certification when requested by the architect.
- C. Obtain each type of hardware (hinges, latch & locksets, exit devices, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. Electrical drawings and electrical specifications are based on the specific electrified hardware components specified in hardware sets. When electronic hardware components other than those indicated in hardware sets are provided, the supplier shall be responsible for all costs incurred by the design team and their consultants to review, and revise electrical drawings and electrical specifications. Supplier shall also be responsible for any additional costs associated with required changes in related equipment, materials, installation, or final hook up to ensure the system will operate and function as indicated in the construction documents, including hardware set operational / functional descriptions.
- E. All hardware items shall be manufactured no earlier than 6 months prior to delivery to site.
- F. Hardware supplier shall be factory trained and certified by the manufacture to provide and support all computer managed locks and system components.
- G. Installation of hardware shall be installed or directly supervised and inspected by a skilled installer certified by the manufacturer of locksets, door closers, and exit devices used on the project, or with not less than 3 years' experience in successful completion of projects similar in size and scope.
- H. Provide hardware for all labeled fire doors, which complies with positive pressure fire testing UL 10C.
- I. Comply with all applicable provisions of the standards referenced within section 1.4 of this specification.
- J. Hardware supplier shall participate when reasonably requested to meet with the contractor and or architect to inspect any claim for incorrect or non-functioning materials; following such inspection, the hardware supplier shall provide a written statement documenting the cause and proposed remedy of any unresolved items.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- A. Hardware supplier shall deliver hardware to the job site unless otherwise specified.
- B. All hardware shall be delivered in manufacturers' original cartons and shall be clearly marked with set and door number.
- C. Coordinate with contractor prior to hardware delivery and recommend secure storage and protection against loss and damage at job site.
- D. Contractor shall receive all hardware and provide secure and proper protection of all hardware items to avoid delays caused by lost or damaged hardware. Contractor shall report shortages to the Architect and hardware supplier immediately after receipt of material at the job site.



- E. Coordinate with related trades under the direction of the contractor for delivery of hardware items necessary for factory installation.

## 1.8 PRE-INSTALLATION MEETING

- A. Schedule a hardware pre-installation meeting on site to review and discuss the installation of continuous hinges, locksets, door closers, exit devices, overhead stops, and electromechanical door hardware.
- B. Meeting attendees shall be notified 7 days in advance and shall include: Architect, Contractor, Door Hardware Installers (including low voltage hardware), Manufacturers representatives for above hardware items, and any other effected subcontractors or suppliers.
- C. All attendees shall be prepared to distribute installation manuals, hardware schedules, templates, and physical hardware samples.

## 1.9 WARRANTY

- A. All hardware items shall be warranted against defects in material and workmanship as set forth in Division One General Requirements.
- B. Repair, replace, or otherwise correct deficient materials and workmanship without additional cost to owner.

## PART 2 - PRODUCTS

### 2.1 FASTENERS

- A. All exposed fasteners shall be Phillips head or as otherwise specified, and shall match the finish of the adjacent hardware. All fasteners ex-posed to the weather shall be non-ferrous or stainless steel. Furnish correct fasteners to accommodate surrounding conditions.
- B. Coordinate required reinforcements for doors and frames. Seek approval of the architect prior to furnishing through-bolts. Furnish through-bolts as required for materials not readily reinforced.

### 2.2 BUTT HINGES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Stanley</u>	<u>Hager</u>	<u>McKinney</u>
1. Standard Weight, Plain Bearing	5PB1	F179	1279	T2714
2. Standard Weight, Ball Bearing	5BB1	BB179	BB1279	TB2714
3. Standard Weight, Ball Bearing, Non-Ferrous	5BB1	FBB191	BB1191	TB2314
4. Heavy Weight, Ball Bearing	5BB1HW	FBB168	BB1168	T4B3786
5. Heavy Weight, Ball Bearing, Non-Ferrous	5BB1HW	FBB199	BB1199	T4B3386

- B. Hinges shall be independently certified by ANSI for compliance with ANSI A156.1 (2006). Hinges shall meet or exceed the following ANSI grade requirements as indicated below:
  - 1. Standard Weight, Plain Bearing Hinges: Grade 3
  - 2. Standard Weight, 2 Ball Bearing Hinges: Grade 2
  - 3. Heavy Weight, 4 Ball Bearing Hinges: Grade 1
- C. Unless otherwise specified, furnish the following hinge quantities for each door leaf.
  - 1. 3 hinges for doors up to 90 inches.
  - 2. 1 additional hinge for every 30 inch on doors over 90 inches.
  - 3. 4 hinges for Dutch door applications.
- D. Unless otherwise specified, top and bottom hinges shall be located as specified in division 8 Section "Hollow Metal Doors and Frames". Intermediate hinges shall be located equidistant from others.
- E. Unless otherwise specified, furnish hinge weight and type as follows:
  - 1. Standard weight: plain bearing hinge 5PB1 for interior openings through 36 inches wide without a door closer.

2. Standard weight: ball bearing hinge 5BB1 for interior opening over 36 through 40 inches wide without a door closer, and for interior openings through 40 inches wide with a door closer.
  3. Heavyweight: 4 ball bearing hinge 5BB1HW for interior openings over 40 inches wide, and for all vestibule doors.
  4. Heavyweight: 4 ball bearing hinge 5BB1HWss for exterior openings unless otherwise listed in groups.
- F. Unless otherwise specified, furnish hinges for exterior doors, fabricated from brass, bronze, or stainless steel. Unless otherwise specified, hinges for interior doors may be fabricated from steel.
- G. Unless otherwise specified, furnish hinges in the following sizes:
1. 5" x 5"                      2-1/4" thick doors
  2. 4-1/2" x 4-1/2"        1-3/4" thick doors
  3. 3-1/2" x 3-1/2"        1-3/8" thick doors
- H. Furnish hinges with sufficient width to accommodate trim and allow for 180-degree swing.
- I. Unless otherwise specified, furnish hinges with flat button tips with non-rising pins at interior doors, non-removable loose pins (NRP) at exterior, and out-swinging lockable interior doors.
- J. Unless otherwise specified, furnish all hinges to template standards.

## 2.3 CONTINUOUS GEARED HINGES

- A. Acceptable manufacturers and respective catalog numbers:
- |                 | <u>Ives</u> | <u>HAGER</u> | <u>PEMKO</u> | <u>STANLEY</u> |
|-----------------|-------------|--------------|--------------|----------------|
| 1. Full Mortise | 112HD       | 780-112HD    | FMSLFHD      | 661HD          |
- A. Hinges shall be independently certified by ANSI for compliance with ANSI A156.26, Grade 1 (2012).
- B. Continuous hinges shall be geared type hinge providing full height door support up to 600 lbs.
- C. Hinge shall be non-handed with symmetrical template hole pattern and factory drilled.
- D. Hinge to be able to carry Warnock Hersey Int. or UL for fire rated doors and frames up to 90 minutes.
- E. Provide machine screws for doors which have been reinforced to accept machine screws.
- F. Note: Fire label for doors and frames should be placed on the header and top rail of fire rated doors and frames.

## 2.4 FLUSH BOLTS AND DUST PROOF STRIKES

- A. Acceptable manufacturers and respective catalog numbers:
- |                                 | <u>Ives</u> | <u>Door Controls</u> | <u>Hager</u> |
|---------------------------------|-------------|----------------------|--------------|
| 1. Dust Proof Strike            | DP2         | 80                   | 280X         |
| 2. Auto Flush Bolt (Metal Door) | FB31P       | 842                  | 292D         |
| 3. Auto Flush Bolt (Wood Door)  | FB41P       | 942                  | 291D         |
- B. Unless otherwise specified, provide 12" rods for manual flush bolts for door 7'6" or less, 24" top rods for doors over 7'6" to 8'6".
- C. Unless otherwise specified, provide doors over 8'6" with automatic top bolts.
- D. Provide automatic flush bolts where required to maintain fire door listing and or egress requirements on pairs of doors.
- E. All flush-bolt applications shall be UL listed to be installed with top flush-bolt only. Provide auxiliary fire bolt as required for fire rated openings where less bottom bolt has been specified.
- F. Provide all bottom flush bolts with non-locking dust proof strikes.

## 2.5 EXIT DEVICES

- A. Acceptable manufacturers and respective catalog numbers:
- |                         | <u>Von Duprin</u> | <u>No Substitution</u> |
|-------------------------|-------------------|------------------------|
| 1. Wide Stile, Push Pad | 99 Series         |                        |
- B. Exit devices shall be independently certified by ANSI for compliance with ANSI A156.3, Grade 1 (2008).
- C. Obtain exit devices from a single manufacturer, although several may be indicated as offering products complying with requirements.
- D. All exit devices shall be equipped with a sound-dampening feature to reduce touch pad return noise.
- E. On full glass doors there shall be no exposed fasteners on the back of the mechanism visible through the glass.
- F. All exit devices shall be provided with flush end caps to reduce potential damage from impact.
- G. All exit devices shall be provided with dead-locking latch bolts to ensure security.
- H. All exit devices shall be U.L. listed for accident hazard. Exit device for use on fire doors shall also be U.L. listed for fire exit hardware.
- I. Provide optional strikes, special length rods, and adapter plates to accommodate door and frame conditions. Provide narrow style series devices in lieu of wide stile series devices where optional strikes will not accommodate door and frame conditions.
- J. Coordinate with related trades to ensure adequate clearance and reinforcement is provided in doors and frames. Provide thru bolts as required.
- K. Refer to hardware groups for exit device applications utilizing the option of: "less bottom rod and floor strike" (LBR)
- L. All exit devices shall be provided with optional trim designs to match other lever and pull designs used on the project.
- M. Unless specific exit device dogging options are noted within hardware sets, provide dogging options as follows:
1. Fire Rated devices: Dogging not permitted.
  2. Non-Rated Exit Only functions not equipped with outside trim or pull: Less Dogging.
  3. Non-Rated Classroom functions: Less Dogging.
  4. Non-Rated devices utilizing electric latch retraction or electrified outside trim: Less Dogging.
  5. All Other Non-Rated devices: Cylinder Dogging utilizing interchangeable core cylinders. Cylinder keyway shall match locksets furnished on this project.
- N. Provide glass bead kits as required to accommodate door conditions. Screws shall not be visible through full glass doors.
- O. Where specified, provide compatible keyed mullions with cylinder for pairs of doors.
- P. Provide reinforced crossbars for all traditional style exit devices applied to doors over 36" wide.

## 2.6 LOCKS AND LATCHES

- A. Acceptable manufacturers and respective catalog numbers:
- |                                | <u>Schlage</u> | <u>No Substitution</u> |
|--------------------------------|----------------|------------------------|
| 1. Grade 1 Mortise             | L Series 06A   |                        |
| 2. Grade 1 Cylindrical         | ND Series RHO  |                        |
| 3. Small Case Mortise Deadbolt | L400 Series    |                        |
- B. Bored locks shall be independently certified by ANSI for compliance with ANSI A156.2 (2011). Interconnected locks shall be independently certified by ANSI for compliance with ANSI A156.12

(2013). Mortise locks shall be independently certified by ANSI for compliance with ANSI A156.13 (2012).

- C. Minimize transmission of heat to lock trim. Provide temperature control modules (TCM) on all electrified locks when cataloged by the lock manufacturer.
- D. Unless otherwise specified, all locks and latches to have:
  - 1. 2-3/4" Backset
  - 2. 1/2" minimum throw latchbolt
  - 3. 1" throw deadbolt
  - 4. ANSI A115.2 strikes
- E. Provide guarded latch bolts for all locksets, and latch bolts with sufficient throw to maintain fire rating of both single and paired door assemblies.
- F. Length of strike lip shall be sufficient to clear surrounding trim.
- G. Provide wrought boxes for strikes at inactive doors, wood frames, and metal frames without integral mortar covers.

## 2.7 PULLS, PUSH BARS, PUSH/PULL PLATES

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Burns</u>	<u>Hager</u>	<u>Ives</u>
1. Push Plate (.050 6"X 16")	56	30S 6 x 16	8200 6" X 16"
2. Pull Plate (1" dia., 10" ctc - .050" X 4" X 16")	5426C	34J 4 x 16	8303-0 4" X 16"
3. Ladder Pull (1" dia., flat tip)	VP4241	915	9266F
4. Flush Pull	459C	16N	960

- A. Adjust dimensions of push plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, push plates shall be factory drilled for cylinders or other mortised hardware. All push plates shall be beveled 4 sides and counter sunk.
- B. Where possible, provide back-to-back, and concealed mounting for pulls and push bars. Push bar length shall be 3" less door width, or center of stile to center of stile for stile & rail or full glass doors.

## 2.8 COORDINATORS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Door Controls</u>	<u>Hager</u>
1. Bar Coordinator	COR x FL	600 x Filler	297D x 297F
2. Mounting Bracket	MB Series	AB, C Series	297 Series

- B. Provide coordinators at all pairs of doors having automatic flush bolts and closers on the inactive leaf, and for pairs of doors having vertical rod/mortise exit device combinations with overlapping astragals.
- C. Provide appropriate filler bars, closer mounting brackets, carry bars, and special top latch preparations as required by adjacent hardware.

## 2.9 CLOSERS

- A. Acceptable manufacturers and respective catalog numbers:

<u>LCN</u>	<u>No Substitution</u>
1. 4040XP / 4040XP EDA	

- B. Door closers shall be independently certified by ANSI for compliance with ANSI A156.4, Grade 1 (2013).
- C. Obtain door closers from a single manufacturer, although several may be indicated as offering products complying with requirements.

- D. Provide extra heavy duty arm (EDA / HD) when closer is to be installed using parallel arm mounting.
- E. Hardware supplier shall coordinate with related trades to ensure aluminum frame profiles will accommodate specified door closers.
- F. Closers shall use high strength cast iron cylinders, forged main arms, and 1 piece forged steel pistons.
- G. Closers shall utilize a stable fluid withstanding temperature range of +120deg F to -30deg F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards UL10C.
- H. Unless otherwise specified, all door closers shall have full covers and separate adjusting valves for sweeps, latch, and backcheck.
- I. Provide closers for all labeled doors. Provide closer series and type consistent with other closers for similar doors specified elsewhere on the project.
- J. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Size all other door closers to allow for reduced opening force not to exceed 5 lbs.
- K. Install closers on the room side of corridor doors, stair side of stairways and interior side of exterior doors.
- L. Closers shall be furnished complete with all mounting brackets and cover plates as required by door and frame conditions, and by adjacent hardware.
- M. Door closers shall be provided with a powder coat finish to provide superior protection against the effects of weathering. Powder coat finish shall successfully pass a 100 hour salt spray test.
- N. Pressure Relief Valve, PRV, shall not be acceptable.

## **2.10 KICK PLATES AND MOP PLATES**

- A. Furnish protective plates as specified in hardware groups.
- B. Where specified, provide 10" kick plates, 34" armor plates, and 4" mop plates. Unless otherwise specified, metal protective plates shall be .050" thick; plastic plates shall be 1/8" thick.
- C. Protective plates shall be 2" less door width, or 1" less door width at pairs. All protective plates shall be beveled 4 sides and counter sunk.
- D. Protection plates over 16" shall not be provided for labeled doors unless specifically approved by door manufacturers listing. When protection plates over 16" are provided for labeled doors, the plate shall be labeled.
- E. Where specified, provide surface mounted door edges. Edges shall butt to protective plates. Provide edges with cutouts as required adjacent hardware.
- F. Adjust dimensions of protection plates to accommodate stile and rail dimensions, lite and louver cutouts, and adjacent hardware. Where required by adjacent hardware, protection plates shall be factory drilled for cylinders or other mortised hardware.

## **2.11 OVERHEAD STOPS**

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Glynn-Johnson</u>	<u>Rixson</u>	<u>Sargent</u>
1. Heavy Duty Surface Mount	GJ900 Series	9 Series	590
2. Heavy Duty Concealed Mount	GJ100 Series	1 Series	690

- B. Unless otherwise specified, furnish GJ900 series overhead stop for hollow metal or 1-3/4" solid core doors equipped with regular arm surface type closers that swing more than 140 degrees before striking a wall, for hollow metal or 1-3/4" solid core doors that open against equipment,

casework, sidelights, or other objects that would make wall bumpers inappropriate, and as specified in hardware groups.

- C. Furnish sex bolt attachments for wood and mineral core doors unless doors are supplied with proper reinforcing blocks.
- D. Provide special stop only ("SE" suffix) overhead stops when used in conjunction with electronic hold open closers.
- E. Do not provide holder function for labeled doors.

## 2.12 WALL STOPS AND HOLDERS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Ives</u>	<u>Hager</u>	<u>Burns</u>
1. Wrought Convex Wall Stop	WS406CVX	232W	570
2. Wrought Concave Wall Stop	WS406CCV	236W	575
3. Automatic Wall Holder	WS40	326W	533

- B. Furnish a stop or holder for all doors. Furnish floor stops or hinge pin stops only where specifically specified.
- C. Provide concave style wall stop at all adjacent integral push button locks; provide convex style wall stop at all other locations.
- D. Where wall stops are not applicable, furnish overhead stops.
- E. Do not provide holder function for labeled doors.

## 2.13 WEATHERSTRIP, GASKETING

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Weatherstrip	429	2891_PK	700NA	755
2. Adhesive Gasket	188	S88	5050	797
3. Mullion Seal/Silencer	8780	5110	5100N	
4. Sweeps	8192	18061_NB	B606	964
5. Drip Cap	142	346	16	R201

- B. Weatherstrip and gasketing shall be independently certified by ANSI for compliance with ANSI A156.22 (2005).
- C. Where specified in the hardware groups, furnish the above products unless otherwise detailed in groups.
- D. Provide weatherstripping all exterior doors and where specified.
- E. Provide intumescent and other required edge sealing systems as required by individual fire door listings to comply with positive pressure standards UL 10C.
- F. Provide Zero 188 smoke gaskets at all fire rated doors and smoke and draft control assemblies.
- G. Provide gasketing for all meeting edges on pairs of fire doors. Gasketing shall be compatible with astragal design provided by door supplier as required for specific fire door listings.

## 2.14 THRESHOLDS

- A. Acceptable manufacturers and respective catalog numbers:

	<u>Zero</u>	<u>Pemko</u>	<u>NGP</u>	<u>Reese</u>
1. Saddle Thresholds	8655	171	425	S205
2. Half Saddle Thresholds	1674	227	324	S239
3. Interlocking Threshold	74A	114	442-5	T550

- A. Thresholds shall be independently certified by ANSI for compliance with ANSI A156.21 (2001).

- B. Hardware supplier shall verify all finish floor conditions and coordinate proper threshold as required to ensure a smooth transition between threshold and interior floor finish.
- C. Threshold Types:
  - 1. Unless otherwise specified, provide saddle threshold similar to Zero 8655 for all exterior openings with an interior floor finish less than or equal to 1/4" in height.
  - 2. Unless otherwise specified, provide half saddle threshold similar to Zero 1674 for all exterior openings with an interior floor finish greater than 1/4" in height. Threshold height shall match thickness of interior floor finish.

## 2.15 ELECTRIC STRIKES

- A. Acceptable manufacturers and respective catalog numbers:
 

	<u>Von Duprin</u>	<u>Folger Adams</u>
1. Type 1	6000 Series	300 Series
- B. Provide electric strikes designed for use with the type of locks shown at each opening where specified.
- C. Electric strikes shall be UL listed as Burglary-Resistant Electric Door Strikes and where required shall be UL listed as Electric Strike for Fire Doors.
- D. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

## 2.16 POWER SUPPLIES

- A. Provide quantities and types as specified in hardware sets. Shared power supplies will not be accepted without prior approval from the owner.
- B. All power supplies shall have the following features:
  - 1. 12/24 VDC Output, field selectable.
  - 2. Class 2 Rated power limited output.
  - 3. Universal 120-240 VAC input.
  - 4. Low voltage DC, regulated and filtered.
  - 5. Polarized connector for distribution boards.
  - 6. Fused primary input.
  - 7. AC input and DC output monitoring circuit w/LED indicators.
  - 8. Cover mounted AC Input indication.
  - 9. Tested and certified to meet UL294.
  - 10. NEMA 1 enclosure.
  - 11. Hinged cover w/lock down screws.
  - 12. High voltage protective cover.
- C. All power supplies shall incorporate fused distribution boards.
- D. All electro-mechanical systems requiring fail safe circuits shall be capable of interfacing with the fire alarm system to cut power to appropriate system components. Unless already provided in another system component, all power supplies utilized in fail safe circuits shall include an integral relay which when connected to the N/C fire alarm contact will cut power to all openings connected to the individual power supply. Power supply, unless otherwise specified, will automatically reset itself when fire alarm relay returns to normal state following a fire alarm.

## 2.17 DOOR POSITION SWITCHES

- A. Acceptable manufacturers and respective catalog numbers:
 

	<u>Schlage Electronics</u>	<u>Sentrol</u>	<u>Sargent</u>
1. Concealed (wood & hollow metal doors)	679 Series	1076W	3287
2. Concealed (aluminum doors)	7764	*****	****

## 2.18 FINISHES AND BASE MATERIALS

- A. Unless otherwise indicated in the hardware groups or herein, hardware finishes shall be applied over base metals as specified in the following finish schedule:

<u>HARDWARE ITEM</u>	<u>BHMA FINISH AND BASE MATERIAL</u>
1. Butt Hinges: Exterior, or Non-Ferrous	630 (US32D - Satin Stainless Steel)
2. Butt Hinges: Interior	652 (US26D - Satin Chromium)
3. Continuous Hinges	630 (US32D - Satin Stainless Steel)
4. Flush Bolts	626 (US26D - Satin Chromium)
5. Exit Devices	626 (US26D - Satin Chromium)
6. Locks and Latches	626 (US26D - Satin Chromium)
7. Pulls and Push Plates/Bars	630 (US32D - Satin Stainless Steel)
8. Coordinators	600 (Prime painted or mill alum.)
9. Closers	689 (Powder Coat Aluminum)
10. Protective Plates	630 (US32D - Satin Stainless Steel)
11. Overhead Stops	630 (US32D - Satin Stainless Steel)
12. Wall Stops and Holders	630 (US32D - Satin Stainless Steel)
13. Thresholds	628 (Mill Aluminum)
14. Weather-strip, Sweeps Drip Caps (wood and hollow metal doors)	Aluminum Anodized
15. Weather-strip, Sweeps Drip Caps (aluminum doors)	Match finish of aluminum doors.
16. Miscellaneous	626 (US26D - Satin Chromium)

## 2.19 KEYING

- A. Acceptable manufacturers and respective catalog numbers:

Schlage      No Substitution

1. Everest 29
- B. Key system shall utilize patented physical construction to protect against the unauthorized manufacturing and, or distribution of aftermarket key blanks and lock cylinders by anyone other than factory authorized dealers. Patent shall be enforceable until 2029.
- C. All locks under this section shall be keyed as directed by the owner to a new Patented Master Key System.
- D. Keying shall be by lock manufacturer where permanent records shall be kept.
- E. Key blanks and cylinders shall be certified to have successfully passed 120,000 cycles (3 times ANSI grade 1 requirements) Cylinder cycle testing criteria shall be in accordance with ANSI A156.5, (2014).
- F. Key blanks shall be warranted against breakage by the manufacture for life.
- G. Furnish a total of 2 keys per cylinder. Actual cut keys to be determined by owner.
- H. Master keys and control keys to be delivered by registered mail to the owner. Change keys shall be delivered in a set up key cabinet. Construction keys shall be delivered to the contractor.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to installation of hardware, installer shall examine door frame installation to ensure frames have been set square and plumb. Installer shall examine doors, door frames, and adjacent wall, floor, and ceiling for conditions, which would adversely affect proper operation and function of door assemblies. Do not proceed with hardware installation until such deficiencies have been corrected.

### 3.2 INSTALLATION

- A. Before hardware installation, general contractor/construction manager shall coordinate a hardware installation seminar with a 1 week notice to all parties involved. The seminar is to be



conducted on the installation of hardware, specifically of locksets, closers, exit devices, continuous hinges and overhead stops. Manufacturer's representative of the above products to present seminar. Seminar to be held at the job site and attended by installers of hardware (including low voltage hardware) for aluminum, hollow metal and wood doors. Training to include use of installation manuals, hardware schedule, templates and physical products samples.

- B. Install all hardware in accordance with the approved hardware schedule and manufacturers instructions for installation and adjustment.
- C. Set units level, plumb and true to the line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accord with industry standards.
- E. Drill appropriate size pilot holes for all hardware attached to wood doors and frames.
- F. Shim doors as required to maintain proper operating clearance between door and frame.
- G. Unless otherwise specified, locate all hardware in accordance with the recommended locations for builders hardware for standard doors and frames as published by the Door and Hardware Institute.
- H. Use only fasteners supplied by or approved by the manufacturer for each respective item of hardware.
- I. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.
- J. Conceal push and pull bar fasteners where possible. Do not install through bolts through push plates.
- K. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the label.
- L. Apply self-adhesive gasketing on frame stop at head & latch side and on rabbet of frame at hinge side.
- M. Install hardware in accordance with supplemental "S" label instructions on all fire rated openings.
- N. Install wall stops to contact lever handles or pulls. Do not mount wall stops on casework, or equipment.
- O. Where necessary, adjust doors and hardware as required to eliminate binding between strike and latchbolt. Doors should not rattle.
- P. Overhead stops used in conjunction with electrified hold open closers shall be templated and installed to coincide with engagement of closer hold open position.
- Q. Install door closers on corridor side of lobby doors, room side of corridor doors, and stair side of stairways.
- R. Adjust spring power of door closers to the minimum force required to ensure exterior and fire rated doors will consistently close and latch doors under existing conditions. Adjust all other door closers to ensure opening force does not to exceed 5 lbs.
- S. Adjust "sweep", "latch", & "back check" valves on all door closers to properly control door throughout the opening and closing cycle. Adjust total closing speed as required to comply with all applicable state and local building codes.
- T. Install "hardware compatible" (bar stock) type weatherstripping continuously for an uninterrupted seal. Adjust templating for parallel arm door closers, exit devices, etc., as required to accommodate weatherstripping.

- U. Unless otherwise specified or detailed, install thresholds with the bevel in vertical alignment with the outside door face. Notch and closely fit thresholds to frame profile. Set thresholds in full bed of sealant.
- V. Compress sweep during installation as recommended by sweep manufacturer to facilitate a water resistant seal.
- W. Deliver to the owner 1 complete set of installation and adjustment instructions, and tools as furnished with the hardware.

### **3.3 FIELD QUALITY CONTROL**

- A. After installation has been completed, the hardware supplier and manufacturers representative for locksets, door closers, exit devices, and overhead stops shall check the project and verify compliance with installation instructions, adjustment of all hardware items, and proper application according to the approved hardware schedule. Hardware supplier shall submit a list of all hardware that has not been installed correctly.
- B. After installation has been completed, the hardware supplier and manufacturers representative shall meet with the owner to explain the functions, uses, adjustment, and maintenance of each item of hardware. Hardware supplier shall provide the owner with a copy of all wiring diagrams. Wiring diagrams shall be opening specific and include both a riser diagram and point to point diagram showing all wiring terminations.

### **3.4 ADJUSTMENT AND CLEANING**

- A. At final completion, and when H.V.A.C. equipment is in operation, installer shall make final adjustments to and verify proper operation of all door closers and other items of hardware. . Lubricate moving parts with type lubrication recommended by the manufacturer.
- B. All hardware shall be left clean and in good operation. Hardware found to be disfigured, defective, or inoperative shall be repaired or replaced.

### **3.5 HARDWARE SCHEDULE**

- A. The following schedule of hardware groups are intended to describe opening function. The hardware supplier is cautioned to refer to the preamble of this specification for a complete description of all materials and services to be furnished under this section.

## **SECTION 088000 GLAZING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds and accessories.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 081213 - Hollow Metal Frames: Glazed borrowed lites.
- B. Section 081416 - Flush Wood Doors: Glazed lites in doors.
- C. Section 084313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

#### **1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- C. ASTM C1036 - Standard Specification for Flat Glass 2021.
- D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021.
- G. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2020.
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2010.
- J. GANA (SM) - GANA Sealant Manual 2008.
- K. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. ITS (DIR) - Directory of Listed Products current edition.
- M. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2017.
- N. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies 2017.
- O. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2017.
- P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2014, with Errata (2017).
- Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2017.
- R. UL (DIR) - Online Certifications Directory Current Edition.
- S. UL 9 - Standard for Fire Tests of Window Assemblies Current Edition, Including All Revisions.
- T. UL 10B - Standard for Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- V. UL 263 - Standard for Fire Tests of Building Construction and Materials Current Edition, Including All Revisions.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit one samples 12 by 12 inch in size of glass units.
- 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 performing the work of this section with minimum three years documented experience.

#### **1.06 FIELD CONDITIONS**

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

#### **1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Float Glass Manufacturers:
  - 1. Cardinal Glass Industries: [www.cardinalcorp.com/#sle](http://www.cardinalcorp.com/#sle).
  - 2. Guardian Industries Corp.: [www.sunguardglass.com/#sle](http://www.sunguardglass.com/#sle).
  - 3. Pilkington North America Inc.: [www.pilkington.com/na](http://www.pilkington.com/na).
  - 4. PPG Industries, Inc.: [www.ppgideascales.com/#sle](http://www.ppgideascales.com/#sle).
  - 5. Oldcastle, Inc..
  - 6. Substitutions: Refer to Section 016000 - Product Requirements.
- B. Fire-Resistance-Rated Glass: Provide products as required to achieve indicated fire-rating period.
  - 1. Manufacturers:
  - 2. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL: [www.safti.com/#sle](http://www.safti.com/#sle).
- C. Fire-Protection-Rated Glass: Provide products as required to achieve indicated fire-rating period.
  - 1. Manufacturers:
  - 2. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite I-XL: [www.safti.com/#sle](http://www.safti.com/#sle).
  - 3. Substitutions: Refer to Section 016000 - Product Requirements.

#### **2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Select type and thickness of exterior glazing assemblies to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  - 3. Glass thicknesses listed are minimum.
- B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
  - 1. In conjunction with vapor retarder and joint sealer materials described in other sections.

- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 5.2/6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

### **2.03 GLASS MATERIALS**

1. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.
2. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

### **2.04 INSULATING GLASS UNITS**

- A. Insulating Glass Units Manufacturers:
1. Any of the manufacturers specified for float glass.
- B. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  3. Spacer Color: Black.
  4. Edge Seal:
  5. Color: Black.
  6. Purge interpane space with dry air, hermetically sealed.
- C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing unless otherwise indicated.
  2. Space between lites filled with air.
  3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
    - b. Coating: Low-E (passive type), on #2 surface.
  4. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    - a. Tint: Clear.
  5. Total Thickness: 1 inch.
  6. Visible Light Transmittance (VLT): 57 percent, nominal.
  7. Solar Heat Gain Coefficient (SHGC): 25 percent, nominal.
  8. Glazing Method: Dry glazing method, gasket glazing.
- D. Type IG-5 - Insulating Glass Units: Safety glazing.
1. Applications:
    - a. Glazed lites in exterior doors.
    - b. Glazed sidelights and panels next to doors.
    - c. Other locations required by applicable federal, state, and local codes and regulations.
  2. Space between lites filled with air.
  3. Glass Type: Same as Type IG-1 except use fully tempered float glass for both outboard and inboard lites.
  4. Total Thickness: 1 inch.

### **2.05 GLAZING UNITS**

- A. Type G-3 - Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and blocks radiant heat, as required to achieve indicated fire-rating period exceeding 45 minutes.
1. Applications:
    - a. Glazing in fire-rated door assembly.
    - b. Glazing in fire-rated window assembly.
    - c. Glazing in sidelites, borrowed lites, and other glazed openings in fire-rated wall assemblies.

2. Glass Type: Multi-laminate annealed glass with intumescent fire retardant interlayers.
  3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
  4. Safety Glazing Certification: 16 CFR 1201 Category II.
  5. Glazing Method: As required for fire rating.
  6. Fire-Rating Period: 45 minutes.
  7. Markings for Fire-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.
    - a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
    - b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
    - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
    - d. "T" - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
    - e. "XXX" - placeholder that represents fire-rating period, in minutes.
- B. Type G-4 - Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire-rating period of 45 minutes or less.
1. Applications:
    - a. Glazing in fire-rated window assembly.
  2. Glass Type: Heat reflective specialty tempered float glass.
  3. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
  4. Safety Glazing Certification: 16 CFR 1201 Category II.
  5. Glazing Method: As required for fire rating.
  6. Fire-Rating Period: 20-45 minutes.
  7. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
    - a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
    - b. "OH" - meets fire window assembly criteria including hose stream test of NFPA 257, or UL 9 fire test standards.
    - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
    - d. "XXX" - placeholder that represents fire-rating period, in minutes.

## 2.06 GLAZING COMPOUNDS

- A. Manufacturers:
1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  2. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com](http://www.momentive.com).
  3. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  4. BASF Corporation: [www.basf.com/us/en.html](http://www.basf.com/us/en.html).
  5. Substitutions: Refer to Section 016000 - Product Requirements.

## 2.07 ACCESSORIES

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.
- D. Glazing Clips: Manufacturer's standard type.
- E. Drips at head.

- F. Flashing at sill.

## **PART 3 EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.

### **3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing sealants in accordance with ASTM C1193, GANA Sealant Manual, and manufacturer's instructions.
- B. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

### **3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

### **3.05 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove non-permanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

### **3.06 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

**END OF SECTION**

**SECTION 092116  
GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal stud wall framing.
- B. Metal channel ceiling framing.
- C. Acoustic insulation.
- D. Gypsum sheathing.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.

**1.02 REFERENCE STANDARDS**

- A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017.
- C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- G. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- H. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- I. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- J. GA-216 - Application and Finishing of Gypsum Panel Products 2018.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
- C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

**PART 2 PRODUCTS**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. ClarkDietrich Building Systems; [ ]: [www.clarkdietrich.com/#sle](http://www.clarkdietrich.com/#sle).
  - 2. Marino: [www.marinoware.com/#sle](http://www.marinoware.com/#sle).
  - 3. Phillips Manufacturing Company: [www.phillipsmfg.com](http://www.phillipsmfg.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- C. Non-Loadbearing 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 flat or formed webs with knurled faces.
  - 2. Ceiling Channels: C-shaped.
  - 3. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
- D. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.



- E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
  - 1. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
  - 2. Deflection and Firestop Track:
    - a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.
- F. Manufacturers - Gypsum-Based Board:
  - 1. American Gypsum Company: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
  - 2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 3. Georgia-Pacific Gypsum: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  - 4. National Gypsum Company; [\_\_\_\_]: [www.nationalgypsum.com/#sle](http://www.nationalgypsum.com/#sle).
  - 5. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  - 6. Substitutions: See Section 016000 - Product Requirements.
- G. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  - 2. Thickness:
    - a. Ceilings: 5/8 inch.
- H. Backing Board For Wet Areas: One of the following products:
  - 1. Application: Surfaces behind tile in wet areas including tub and shower surrounds and shower ceilings.
  - 2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
    - a. Regular Type: Thickness 1/2 inch.
    - b. Products:
      - 1) Georgia-Pacific Gypsum; DensShield Tile Backer.
      - 2) National Gypsum Company; Gold Bond eXP Tile Backer.
      - 3) Substitutions: See Section 016000 - Product Requirements.
- I. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Ceilings, unless otherwise indicated.
  - 2. Thickness: 5/8 inch.
  - 3. Edges: Tapered.
  - 4. Products:
    - a. American Gypsum; Interior Ceiling Board.
    - b. CertainTeed Corporation; ProRoc Interior Ceiling.
    - c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
    - d. Lafarge North America Inc; Sagcheck.
    - e. National Gypsum Company; High Strength Brand Ceiling Board.
    - f. Pacific Coast Building Products, Inc; PABCO Ceiling Board.
    - g. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
    - h. Substitutions: See Section 016000 - Product Requirements.
  - 5. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
  - 6. Core Type: Regular.
  - 7. Regular Board Thickness: 1/2 inch.
  - 8. Glass Mat Faced Products:
    - a. CertainTeed Corporation; GlasRoc Brand.
    - b. Georgia-Pacific Gypsum; DensGlass Sheathing.
    - c. National Gypsum Company; Gold Bond eXP Sheathing.
    - d. Substitutions: See Section 016000 - Product Requirements.
- J. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 6 inch.
- K. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless noted otherwise.

- L. Decorative Metal Trim:
  - 1. Material: Extruded aluminum alloy 6063-T5 temper.
  - 2. Finish: Anodized, clear.
  - 3. Type: As shown on drawings.
  - 4. Reveal Trim:
    - a. Products:
      - 1) Fry Reglet.
      - 2) Substitutions: See Section 016000 - Product Requirements.
- M. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
  - 1. Chemical hardening type compound.
- N. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.
- O. 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.

## **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 at 16 inches on center.
- C. Studs: Space studs at 16 inches on center.
  - 1. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Blocking: Install wood blocking for support of:
  - 1. Framed openings.
  - 2. Wall mounted cabinets.
  - 3. Plumbing fixtures.
  - 4. Toilet partitions.
  - 5. Toilet accessories.
  - 6. Wall mounted door hardware.

### **3.03 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

### **3.04 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

### **3.05 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
  - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

### **3.06 JOINT TREATMENT**

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
  - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  - 3. Feather coats of joint compound so that camber is maximum 1/32 inch.

**END OF SECTION**

**SECTION 092216  
NON-STRUCTURAL METAL FRAMING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood blocking within stud framing.
- B. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

**1.03 REFERENCE STANDARDS**

- A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- C. 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 2020.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Metal Framing, Connectors, and Accessories:
  - 1. Clarkwestern Dietrich Building Systems LLC: [www.clarkdeitrich.com](http://www.clarkdeitrich.com).
  - 2. Marino: [www.marinoware.com/#sle](http://www.marinoware.com/#sle).
  - 3. Simpson Strong Tie: [www.strongtie.com/#sle](http://www.strongtie.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.

**2.02 FRAMING MATERIALS**

- A. Non-Loadbearing 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/240 at 5 psf.
  - 1. Studs: C shaped with flat or formed webs with knurled faces.
  - 2. Runners: U shaped, sized to match studs.
  - 3. Ceiling Channels: C shaped.
  - 4. Furring: Hat-shaped and Z shaped sections, minimum depth of 7/8 inch.
  - 5. Steel Stud Framing Connectors:
    - a. Products:
      - 1) Simpson Strong Tie, Bridging Connectors; DBC Bridging Connector: [www.strongtie.com](http://www.strongtie.com).
      - 2) Substitutions: See Section 016000 - Product Requirements.
- B. Loadbearing Studs: As specified in Section 054000.
- C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
- D. 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 .
- E. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.
- F. Fasteners: ASTM C1002 self-piercing tapping screws.
- G. Anchorage Devices: Powder actuated.

**2.03 FABRICATION**

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

#### **3.02 INSTALLATION OF STUD FRAMING**

- A. Extend partition framing to structure where indicated and to ceiling in other locations.
- B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- C. Align and secure top and bottom runners at 24 inches on center.
- D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- E. Align stud web openings horizontally.
- F. Secure studs to tracks using crimping method. Do not weld.
- G. Fabricate corners using a minimum of three studs.
- H. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- I. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

#### **3.03 CEILING AND SOFFIT FRAMING**

- A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- B. Install furring independent of walls, columns, and above-ceiling work.
- C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.
- D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

#### **3.04 TOLERANCES**

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

### **END OF SECTION**

## **SECTION 093000 TILING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Tile for wall applications.
- B. Coated glass mat backer board as tile substrate.
- C. Ceramic accessories.
- D. Non-ceramic trim.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.
- B. Section 092116 - Gypsum Board Assemblies: Tile backer board.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium). 2017.
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- C. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive 2013 (Revised).
- D. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2010 (Reaffirmed 2016).
- E. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014.
- F. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018.
- G. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.
- H. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2019.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Tile: 5 percent of each size, color, and surface finish combination.

#### **1.05 QUALITY ASSURANCE**

- A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications:
  - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

- D. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### **1.07 FIELD CONDITIONS**

- A. Do not install solvent-based products in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

### **PART 2 PRODUCTS**

#### **2.01 TILE**

- A. Manufacturers: All products of each type by the same manufacturer.
  - 1. Ceramic Tileworks.
  - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Porcelain Wall Tile, Type PT-1: ANSI A137.1, standard grade.
  - 1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  - 2. Size: 8 by 24 inch, nominal.
  - 3. Thickness: 5/16 inch.
  - 4. Edges: Square.
  - 5. Color(s): Lead Glossy.
  - 6. Pattern: Straight Stack.
  - 7. Products:
    - a. Smooth by Ceramic Tileworks.
    - b. Substitutions: See Section 016000 - Product Requirements.
- C. Non-Ceramic Trim: Satin natural anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
  - 1. Applications:
    - a. Open edges of wall tile.
    - b. Open edges of floor tile.
    - c. Wall corners, outside and inside.
    - d. Transition between floor finishes of different heights.
    - e. Thresholds at door openings.
    - f. Expansion and control joints, floor and wall.
    - g. Borders and other trim as indicated on drawings.
  - 2. Manufacturers:
    - a. Schluter-Systems: [www.schluter.com/#sle](http://www.schluter.com/#sle).
    - b. Genesis APS International: [www.genesis-aps.com/#sle](http://www.genesis-aps.com/#sle).

#### **2.02 SETTING MATERIALS**

- A. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - 2. Bostik Inc: [www.bostik-us.com/#sle](http://www.bostik-us.com/#sle).
  - 3. Custom Building Products: [www.custombuildingproducts.com/#sle](http://www.custombuildingproducts.com/#sle).
  - 4. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 5. Merkrete, by Parex USA, Inc: [www.merkrete.com/sle](http://www.merkrete.com/sle).
  - 6. ProSpec, an Oldcastle brand: [www.prospec.com](http://www.prospec.com).
- B. Provide setting materials made by the same manufacturer as grout.
- C. Latex-Portland Cement Mortar Bond Coat: {\rs\#1}, {\rs\#1}, or [\_\_\_\_].
  - 1. Products:
    - a. ARDEX Engineered Cements; ARDEX X 77 MICROTEC: [www.ardexamericas.com](http://www.ardexamericas.com).
    - b. AVM Industries, Inc; Thin-Set 780: [www.avmindustries.com](http://www.avmindustries.com).
    - c. LATICRETE International, Inc; LATICRETE 254 Platinum: [www.laticrete.com](http://www.laticrete.com).
    - d. Substitutions: See Section 016000 - Product Requirements.

#### **2.03 GROUTS**

- A. Manufacturers:
  - 1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - 2. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - 3. Basis of Design: Mapei.
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Standard Grout: ANSI A118.6 standard cement grout.
  - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  - 3. Color(s): As indicated on drawings.
  - 4. Products:
    - a. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
- C. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
  - 1. Color(s): As indicated on drawings.
  - 2. Products:
    - a. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- D. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
  - 1. Composition: Water-based colorless silicone.

## **2.04 ACCESSORY MATERIALS**

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
  - 1. Thickness: 20 mils, maximum.
  - 2. Crack Resistance: No failure at 1/16 inch gap, minimum.
  - 3. Products:
    - a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
- C. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.



- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Sound tile after setting. Replace hollow sounding units.
- H. Keep control and expansion joints free of mortar, grout, and adhesive.
- I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.
- M. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
  - 2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

### **3.05 INSTALLATION - WALL TILE**

- A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

### **3.06 CLEANING**

- A. Clean tile and grout surfaces.

### **3.07 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

### **END OF SECTION**

**SECTION 095100  
ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.02 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2017.
- B. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2019.

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.
- D. Samples: Submit one samples each, 6 inches long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures.

**1.04 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**PART 2 PRODUCTS**

**2.01 ACOUSTICAL UNITS**

- A. Manufacturers: Basis of Design: Mars by USG
  - 1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. Acoustic Ceiling Products, Inc.: [www.acpideas.com](http://www.acpideas.com).
  - 3. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 4. Hunter Douglas Contract: [www.hunterdouglascontract.com](http://www.hunterdouglascontract.com).
  - 5. USG: [www.usg.com](http://www.usg.com).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Acoustical Panels ACT-1: Mineral fiber with membrane-faced overlay, with the following characteristics:
  - 1. Classification: ASTM E1264 Type IV.
    - a. Form: 1 & 2, nodular and water felted.
  - 2. Size: 24 by 24 inches.
  - 3. Thickness: 3/4 inch.
  - 4. Light Reflectance: not less than 90 percent, determined in accordance with ASTM E1264.
  - 5. NRC: Not less than 0.75.
  - 6. Ceiling Attenuation Class (CAC): > 35, determined in accordance with ASTM E1264.
  - 7. Panel Edge: Square.
  - 8. Color: White.

**2.02 SUSPENSION SYSTEM(S)**

- A. Manufacturers:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. Acoustic Ceiling Products, Inc.: [www.acpideas.com](http://www.acpideas.com).
  - 3. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  - 4. Chicago Metallic Corporation: [www.chicagometallic.com](http://www.chicagometallic.com).
  - 5. Hunter Douglas Contract: [www.hunterdouglascontract.com](http://www.hunterdouglascontract.com).
  - 6. USG: [www.usg.com](http://www.usg.com).
  - 7. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold

down clips as required.

- C. Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
  - 1. Profile: Tee; 15/16 inch wide face.
  - 2. Construction: Double web.
  - 3. Finish: White painted.
  - 4. Products:
    - a. Basis of Design: Donn DX by USG.
    - b. Substitutions: See Section 016000 - Product Requirements.

### **2.03 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Hanger Wire: 12-gage 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same material and finish as grid.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 PREPARATION**

- A. Install after major above-ceiling work is complete.
- B. Coordinate the location of hangers with other work.

### **3.03 INSTALLATION - SUSPENSION SYSTEM**

- A. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- B. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- C. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- F. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- G. Do not eccentrically load system or induce rotation of runners.
- H. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
  - 2. Overlap and rivet corners.

### **3.04 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.

### **3.05 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION**

## **SECTION 096500 RESILIENT FLOORING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Resilient base.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2021.
- C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile 2004 (Reapproved 2018).
- D. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- E. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2019.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Wall Base: 5% of linear feet of each type and color.

#### **1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years experience and approved by flooring manufacturer.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

#### **1.07 FIELD CONDITIONS**

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

### **PART 2 PRODUCTS**

#### **2.01 STAIR COVERING**

#### **2.02 RESILIENT BASE**

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
  - 1. Manufacturers: Basis of Design: VPI Corporation

- a. Burke Flooring: [www.burkeflooring.com/#sle](http://www.burkeflooring.com/#sle).
- b. Johnsonite, a Tarkett Company: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
- c. Roppe Corp: [www.roppe.com/#sle](http://www.roppe.com/#sle).
- d. Substitutions: See Section 016000 - Product Requirements.
- 2. Height: 4 inch.
- 3. Thickness: 0.125 inch.
- 4. Finish: Matte.
- 5. Color: Burnt Umber.
- 6. Manufacturers: Basis of Design: Johnsonite
  - a. Burke Flooring: [www.burkemercer.com](http://www.burkemercer.com).
  - b. Roppe Corp: [www.roppe.com](http://www.roppe.com).

### **2.03 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

### **3.02 PREPARATION**

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.
- D. Clean substrate.

### **3.03 INSTALLATION - GENERAL**

- A. Install in accordance with manufacturer's written instructions.

### **3.04 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### **3.05 INSTALLATION - STAIR COVERINGS**

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

### **3.06 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

### **3.07 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION**

**SECTION 096700  
FLUID-APPLIED FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fluid-applied flooring and base.

**1.02 REFERENCE STANDARDS**

- A. ASTM D570 - Standard Test Method for Water Absorption of Plastics 1998 (Reapproved 2018).

**1.03 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing work of this section with minimum three years experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

**1.06 FIELD CONDITIONS**

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fluid-Applied Flooring: Basis of Design: Dur-A-Chip by Dur-A-Flex
  1. BASF Construction Chemicals-Building Systems: [www.buildingsystems.basf.com](http://www.buildingsystems.basf.com).
  2. Concrete Solutions by Rhino Linings: [www.concretesolutions.com](http://www.concretesolutions.com).
  3. Crossfield Products Corp: [www.crossfieldproducts.com](http://www.crossfieldproducts.com).
  4. Key Resin Company: [www.keyresin.com](http://www.keyresin.com).
  5. Sherwin-Williams Company: General Polymers Brand: [www.generalpolymers.com/#sle](http://www.generalpolymers.com/#sle).
  6. Sika Corporation: [www.sikafloorusa.com/#sle](http://www.sikafloorusa.com/#sle).
  7. Substitutions: See Section 016000 - Product Requirements.

**2.02 MATERIALS**

- A. Fluid-Applied Flooring Type EPX-1: Epoxy base coat(s) with embedded quartz aggregate.
  1. Top Coat: Aliphatic Urethane- Dur-A-Flex Armor Top.
  2. Thickness: 1/8 inch, nominal, when dry.
  3. Texture: Slip resistant.
  4. Sheen: Matte.
  5. Color: As selected by Architect.
  6. Products:
    - a. DUR-A-FLEX- DUR-A-CHIP Floor System.

- b. Substitutions: See Section 016000 - Product Requirements.

## **2.03 ACCESSORIES**

- A. Divider Strips: Extruded anodized aluminum, 1/8 inch thick, height to match flooring thickness, with anchoring features; Clear anodized color.
- B. Base Caps, and Separator Strips: Match divider strips, with projecting base of 1/8 inch.
- C. Cant Strips: Molded of flooring resin material.
- D. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- E. Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with sub-floor filler.
- B. Apply primer to surfaces required by flooring manufacturer.

### **3.03 INSTALLATION - STRIPS**

- A. Accurately saw cut substrate to install divider strips.
- B. Install strips straight and level to locations indicated.

### **3.04 INSTALLATION - FLOORING**

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness indicated.
- C. Finish to smooth level surface.

### **3.05 PROTECTION**

- A. Prohibit traffic on floor finish for 48 hours after installation.
- B. Barricade area to protect flooring until fully cured.

**END OF SECTION**



**SECTION 099000  
PAINTING AND COATING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.
- C. Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Exposed surfaces of steel lintels and ledge angles.
  - 2. Mechanical and Electrical:
    - a. In finished areas, paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Floors, unless specifically so indicated.
  - 6. Glass.
  - 7. Concealed pipes, ducts, and conduits.

**1.02 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications: Shop-primed items.

**1.03 REFERENCE STANDARDS**

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2016.

**1.04 SUBMITTALS**

- A. See Section 013000 - 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. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
  - 1. Where sheen is specified, submit samples in only that sheen.
- D. Samples: Submit two painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on [\_\_\_\_], 4 x 8 inch in size.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures.
- F. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three 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 paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint 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. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  - 1. Diamond Vogel Paints: [www.diamondvogel.com/#sle](http://www.diamondvogel.com/#sle).
  - 2. Duron, Inc: [www.duron.com/#sle](http://www.duron.com/#sle).
  - 3. Glidden Professional, a product of PPG Architectural Coatings: [www.gliddenprofessional.com](http://www.gliddenprofessional.com).
  - 4. Benjamin Moore & Co: [www.benjaminmoore.com/#sle](http://www.benjaminmoore.com/#sle).
  - 5. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 6. Pratt & Lambert Paints: [www.prattandlambert.com/#sle](http://www.prattandlambert.com/#sle).
  - 7. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Block Fillers: Same manufacturer as top coats.
- E. Substitutions: See Section 016000 - Product Requirements.

### **2.02 PAINTS AND COATINGS - GENERAL**

- A. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
  - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
  - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
- B. Primers: As follows unless other primer is required or recommended by manufacturer of top coats; where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- C. Flammability: Comply with applicable code for surface burning characteristics.
- D. Colors: As indicated on drawings
  - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

### **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Paint ME-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
  - 1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
  - 2. Semi-gloss: Two coats of alkyd enamel; Devco's DevGuard Semi-Gloss Alkyd 4306-xxxx.

### **2.04 PAINT SYSTEMS - INTERIOR**

- A. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
  - 1. Shop primer by others.
  - 2. Intermediate Coat: same as finish.
  - 3. Top Coat: Waterborne Flat Dryfall: P&L Industrial Waterborne Flat Dryfall Z5900
  - 4. Flat: MPI gloss level 1; use this sheen at all locations.
- B. Paint CI-OP-3L - Concrete/Masonry, Opaque, Latex, 3 Coat:
  - 1. One coat of block filler.
  - 2. Semi-gloss: Two coats of latex epoxy; P&L Industrial PreCat Semi-Gloss Latex Epoxy Z7231series.
- C. Paint MI-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coat:
  - 1. Touch-up with alkyd primer.
  - 2. Semi-gloss: Two coats of alkyd enamel; P&L Pro-Hide Gold Interior Alkyd Semi-Gloss S889xseries.
- D. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
  - 1. One coat of latex primer sealer.
  - 2. Semi-gloss: Two coats of latex epoxy; Industrial PreCat Semi-Gloss Latex Epoxy Z7231.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin application of coatings until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- 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. Gypsum Wallboard: 12 percent.
  - 2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- F. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- G. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

- H. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- I. Corroded Steel and Iron Surfaces to be Painted: Prepare using at least SSPC-SP 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).
- J. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
- K. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

### **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 instructions.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.
- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### **3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### **3.05 PROTECTION**

- A. Protect finished coatings until completion of project.
- B. Touch-up damaged coatings after Substantial Completion.

### **END OF SECTION**

**SECTION 102113.19  
PLASTIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Solid plastic toilet compartments.
- B. Urinal screens.

**1.02 REFERENCE STANDARDS**

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- C. Product Data: Provide data on panel construction, hardware, and accessories.
- D. Samples: Submit two samples of partition panels, 2 by 2 inch in size illustrating panel finish, color, and sheen.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Solid Plastic Toilet Compartments:
  - 1. Ampco Products, Inc: [www.ampco.com/#sle](http://www.ampco.com/#sle).
  - 2. Metpar Corp: [www.metpar.com/#sle](http://www.metpar.com/#sle).
  - 3. Partition Systems International of South Carolina; PolyLife HDPE Toilet Partitions: [www.psisc.com/#sle](http://www.psisc.com/#sle).
  - 4. Bradmar by Bradley Corporation.
  - 5. Basis of Design: Hiny Hiders by Scranton Products
  - 6. Substitutions: Section 016000 - Product Requirements.

**2.02 PLASTIC TOILET COMPARTMENTS**

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), floor-mounted headrail-braced.
  - 1. Color: To be selected from manufacturers standard range.
- B. Doors:
  - 1. Thickness: 1 inch.
  - 2. Width: 24 inch. Out swinging
  - 3. Width for Handicapped Use: 36 inch, out-swinging.
  - 4. Height: 55 inch.
- C. Panels:
  - 1. Thickness: 1 inch.
  - 2. Height: 55 inch.
- D. Pilasters:
  - 1. Thickness: 1 inch.
  - 2. Width: As required to fit space; minimum 3 inch.
- E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

**2.03 ACCESSORIES**

- 1. Provide ceiling attachment using two adjustable hanging studs, attached to above-ceiling framing.
- B. Pilaster Brackets: Polished stainless steel.
- C. Wall Brackets: Continuous type, polished stainless steel.
- 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. Hardware: Natural anodized aluminum:
  1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
  2. Door Latch: Slide type with exterior emergency access feature.
  3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
  4. Coat hook with rubber bumper; one per compartment, mounted on door.
  5. Provide door pull for outswinging doors.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

### **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.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

### **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 outswinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

**END OF SECTION**

**SECTION 102239  
FOLDING PANEL PARTITIONS**

**Part 1 - GENERAL**

**1.01 DESCRIPTION**

- A. General
  - 1. Furnish and install operable partitions and suspension system. Provide all labor, materials, tools, equipment, and services for operable walls in accordance with provisions of contract documents.

**1.02 RELATED WORK BY OTHERS**

- A. Preparation of opening will be by General Contractor. Any deviation of site conditions contrary to approved shop drawings must be called to the attention of the architect.
- B. All header, blocking, support structures, jambs, track enclosures, surrounding insulation, and sound baffles as required in 1.04 Quality Assurance.
- C. Prepunching of support structure in accordance with approved shop drawings.
- D. Paint or otherwise finishing all trim and other materials adjoining head and jamb of operable partitions.

**1.03 SUBMITTALS**

- A. Complete shop drawings are to be provided prior to fabrication indicating construction and installation details. Shop drawings must be submitted within 60 days after receipt of signed contract.

**1.04 QUALITY ASSURANCE**

- A. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions
- B. The partition STC (Sound Transmission Classification) shall be achieved per the standard test methods ASTM E90.
- C. Noise isolation classifications shall be achieved per the standard test methods ASTM E336 and ASTM E413.
- D. Noise Reduction Coefficient (NRC) ratings shall be per ASTM C423.
- E. Rack testing for 10 years. (tensional strength stress test)
- F. The manufacturer shall have a quality system that is registered to the ISO 9001 standards.

**1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Proper storage of partitions before installation and continued protection during and after installation will be the responsibility of the General Contractor.

**1.06 WARRANTY**

- A. Partition system shall be guaranteed for a period of two years against defects in material and workmanship, excluding abuse.

**Part 2 – PRODUCTS**

**2.01 ACCEPTABLE MANUFACTURERS**

- A. Upon compliance with all of the criteria specified in this section, Manufacturers wishing to bid products equal to the product specified must submit to the architect 10 days prior to bidding complete data in support of compliance and a list of three past installations of products similar to those listed. The submitting manufacturer guarantees the proposed substituted product complies with the performance items specified and as detailed on the drawings.

**2.02 MATERIALS**

- A. Product to be top supported Series 641 individual, omni-directional panels as manufactured by Hufcor Inc.
  - 1. Panels shall be nominally 4" [102] thick and to 48" [1219] in width.

2. Panel faces shall be laminated to appropriate substrate to meet the STC requirement in 2.04 Acoustical Performance.
3. Frames shall be of 16 gauge [1.42mm] painted steel with integral factory applied aluminum vertical edge and face protection.
4. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.
5. Horizontal top seals shall be retractable, provide 1" [25] nominal operating clearance, and exert upward force when extended. All panels, including pass door panels and lever closure panels must have retractable top and bottom seals.
6. Horizontal bottom seals shall be retractable, provide up to 2" [51] nominal operating clearance, and exert downward force when fully extended.
7. Horizontal trim shall be of aluminum.
- B. Weight of the panels shall be 7.8-13.6 lbs./sq. ft. [37.8.2-66.4 kg/sq.m] based on options selected.
- C. Suspension system:
  1. For panels to 1000 lbs. [455 kg] or 22'2" [6.75m]: Track shall be of clear anodized architectural grade extruded aluminum alloy 6063-T6. Track design shall provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. Track shall be connected to the structural support by pairs of minimum 3/8" [10] dia. threaded steel hanger rods. Pairs of rods are directly attached to the track, no single point attachment allowed. L, T, or X intersections shall be factory assembled and welded.
    - a. Each panel shall be supported by two 2-wheeled counter-rotating horizontal carriers. Wheels to be of precision ground steel ball bearings with heat treated and hardened races encased with molded polymer tires.
  2. For panels 1000-1500 lbs. [455-680 kg]: Track shall be of clear anodized architectural grade extruded aluminum alloy 6063-T6. Track design shall provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. . Track shall be connected to the structural support by pairs of minimum 1/2" [13] dia. threaded steel hanger rods. Pairs of rods are directly attached to the track, no single point attachment allowed. L, T, or X intersections shall be factory assembled and welded.
    - a. Each panel shall be supported by two 2-wheeled counter-rotating horizontal carriers. Wheels to be of precision ground steel ball bearings with heat treated and hardened races encased with molded polymer tires, steel banded and reinforced.
  3. Plenum closure (by others): Design of plenum closure must permit lifting out of header panels to adjust track height. Plenum closure required for optimum sound control of partition.
- D. Finishes
  1. Face finish shall be: (select as required):
    - a. Factory applied reinforced vinyl fabric with woven backing, weighing not less than 20 oz. per lineal yard [620 g/m]. Color shall be selected from manufacturer's standard color selectors.
    - b. Provide factory installed recessed Markerboards on each panel on classroom 950 side
  2. Exposed metal trim and seal color shall be (select from Hufcor's Standard Trim selector):
    - a. Gray
    - b. Putty
    - c. Black
    - d. White
  3. Aluminum track shall be clear anodized
- E. Available Accessories/Options
  1. Inset chalk/writing/projection surfaces
  2. Inset eraser pocket



## **2.03 OPERATION**

- A. Panels shall be manually moved from the storage area, positioned in the opening, and seals set.
- B. Retractable Horizontal Seals
  - 1. Retractable horizontal seals shall be activated by a removable quick-set operating handle located approximately 42" [1067] from the floor in the panel edge.
  - 2. Top and bottom retractable seals shall be operated simultaneously.
  - 3. Seal activation requires approximately a 190 degree turn of the removable handle.  
Optional 4" bottom seals: Seal activation requires a lift/drop motion of the removable handle.
- C. Final partition closure to be by lever closure panel with expanding jamb which compensates for minor wall irregularities and provides a minimum of 250 lbs. [113.4 kg] seal force against the adjacent wall for optimum sound control. The jamb activator shall be located approximately 45" [1143] from the floor in the panel face and be accessed from either side of the panel. The jamb is equipped with a mechanical rack and pinion gear drive mechanism and shall extend 4"-6" [102-152] by turning the removable operating handle.
- D. Stack/Store Panels
  - 1. Retract seals with removable operating handle and move to storage area.

## **2.04 ACOUSTICAL PERFORMANCE**

- A. Acoustical performance shall be tested at a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards. Standard panel construction shall have obtained an STC rating of , 54, .  
(Not all substrates are available in all STC ratings)
  - 1. Complete, unaltered written test report is to be made available upon request.

## **Part 3 - EXECUTION**

- A. Installation. The complete installation of the operable wall system shall be by an authorized factory-trained installer and be in strict accordance with the approved shop drawings and manufacturer's standard printed specifications, instructions, and recommendations.
- B. Cleaning
  - 1. All track and panel surfaces shall be wiped clean and free of handprints, grease, and soil.
  - 2. Cartoning and other installation debris shall be removed to onsite waste collection area, provided by others.
- C. Training
  - 1. Installer shall demonstrate proper operation and maintenance procedures to owner's representative.
  - 2. Operating handle and owner's manuals shall be provided to owner's representative.

**END OF SECTION**

**SECTION 102800  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Residential toilet, shower, and bath accessories.
- C. Accessories for toilet rooms, showers, residential bathrooms, and utility rooms.
- D. Paper towel dispensers.
- E. Utility room accessories.
- F. Grab bars.

**1.02 RELATED REQUIREMENTS**

- A. Section 088300 - Mirrors: Other mirrors.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2020.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.
- F. ASTM C1036 - Standard Specification for Flat Glass 2021.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement and concealed ceiling supports to receive anchor attachments.

**1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Toilet Accessories:
  - 1. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).
  - 2. ASI - American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
  - 3. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
  - 4. Bobrick Washroom Equipment, Inc..
- B. All items of each type to be made by the same manufacturer.

**2.02 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

- D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- E. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- F. Adhesive: Two component epoxy type, waterproof.
- G. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

## **2.03 FINISHES**

- A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, satin finish, unless otherwise noted.
- C. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.
- D. Toilet Paper Dispenser: Double roll, surface mounted bracket type, chrome-plated zinc alloy brackets, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
  - 1. Products:
    - a. Bobrick B-265.
- E. Paper Towel Dispenser: Folded paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator and tumbler lock.
  - 1. Products:
    - a. Bobrick B-262.
- F. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.
  - 1. Minimum Capacity: 40 ounces.
  - 2. Products:
    - a. Bobrick B-2111.
- G. Grab Bars: Stainless steel, nonslip grasping surface finish.
  - 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.
    - d. Products:
      - 1) Substitutions: Section 016000 - Product Requirements.
- H. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
  - 1. Products:
    - a. Bobrick B-254.
    - b. Substitutions: Section 016000 - Product Requirements.
- I. Robe Hook: Stainless steel, surface-mounted, Bright-polished stainless steel. Flange is 2" x 2" (50 x 50mm). Projects 3 3/8" (85mm) from wall..
  - 1. Products:
    - a. Bobrick B-677.
    - b. Substitutions: Section 016000 - Product Requirements.

## **2.04 UTILITY ROOM ACCESSORIES**

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  - 1. Drying rod: Stainless steel, 1/4 inch diameter.
  - 2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
  - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
  - 4. Length: 36 inches.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. 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, unless otherwise indicated.
  - 1. Grab Bars: As indicated on the drawings.
  - 2. Mirrors: 3' 4" inch, measured to bottom of mirrored surface.
  - 3. Other Accessories: As indicated on the drawings.

### **3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

**SECTION 104400  
FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features.
- D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.05 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Ansul, a Tyco Business; Cleanguard: [www.ansul.com/#sle](http://www.ansul.com/#sle).
  - 2. Kidde, a unit of United Technologies Corp: [www.kidde.com/#sle](http://www.kidde.com/#sle).
  - 3. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 4. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 5. Pyro-Chem, a Tyco Business: [www.pyrochem.com/#sle](http://www.pyrochem.com/#sle).
  - 6. Strike First Corporation of America; Water Fire Extinguisher: [www.strikefirstusa.com](http://www.strikefirstusa.com).
  - 7. Substitutions: See Section 016000 - Product Requirements.
  - 8. Ansul, a Tyco Business: [www.ansul.com/#sle](http://www.ansul.com/#sle).
  - 9. JL Industries, Inc: [www.jlindustries.com](http://www.jlindustries.com).
  - 10. Larsen's Manufacturing Co: [www.larsensmfg.com/#sle](http://www.larsensmfg.com/#sle).
  - 11. Potter-Roemer: [www.potterroemer.com/#sle](http://www.potterroemer.com/#sle).
  - 12. Pyro-Chem, a Tyco Business: [www.pyrochem.com/#sle](http://www.pyrochem.com/#sle).
  - 13. Strike First Corporation of America; EL-Elite Architectural Series Fire Extinguisher Cabinet, Non-Fire Rated: [www.strikefirstusa.com](http://www.strikefirstusa.com).

**2.02 FIRE EXTINGUISHERS**

- 1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Class: A:B:C type.
  - 2. Size: 10 pound.
  - 3. Finish: Baked polyester powder coat Red color.
  - 4. Temperature range: Minus 40 degrees F to [ ] degrees F.

**2.03 FIRE EXTINGUISHER CABINETS**

- A. Metal: Formed aluminum.
- B. Cabinet Configuration: Recessed type.
  - 1. Size to accommodate accessories.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

- D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.
- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: No. 4 - Brushed stainless steel.
- H. Finish of Cabinet Interior: White colored enamel.

#### **2.04 ACCESSORIES**

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Cabinet Signage: FIRE EXTINGUISHER.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 40 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

**END OF SECTION**

## **SECTION 122400 WINDOW SHADES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Window shades and accessories.
- B. Electric motor operators.
- C. Motor controls.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.
- B. Section 092116 - Gypsum Board Assemblies: Substrate for window shade systems.

#### **1.03 REFERENCE STANDARDS**

- A. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments 2019.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. WCMA A100.1 - Safety of Window Covering Products 2018.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
  - 2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.
- B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of all affected installers.
- C. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken.
  - 2. Do not install shades until final surface finishes and painting are complete.

#### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
  - 1. Motorized Shades: Include power requirements and standard wiring diagrams.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details.
- D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
- E. Selection Samples: Include fabric samples in full range of available colors and patterns.
  - 1. Motorized Shades: Include finish selections for controls.
- F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- I. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- J. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

#### **1.07 FIELD CONDITIONS**

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### **1.08 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
  - 1. Shade Hardware: 25 years.
  - 2. Fabric: 25 years.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Manually operated and motorized roller shades shall be provided from the same manufacturer.
  - 1. Manually Operated Roller Shades:
    - a. Draper, Inc; Clutch Operated FlexShade: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).
    - b. Lutron Electronics Co., Inc: [www.lutron.com/#sle](http://www.lutron.com/#sle).
    - c. Hunter Douglas: [www.hunterdouglas.com](http://www.hunterdouglas.com).
    - d. SWFcontract, a division of Springs Window Fashions, LLC.: [www.swfcontract.com/#sle](http://www.swfcontract.com/#sle).
    - e. Substitutions: See Section 016000 - Product Requirements.

#### **2.02 WINDOW SHADE APPLICATIONS**

- A. Shades: Solar Screen Fabric.
  - 1. Type: Roller shades.
  - 2. Fabric: Basis of Design: GreenScreen Revive 1%.
  - 3. Color: As selected by Architect from manufacturer's full range of colors.
  - 4. Mounting: Inside (between jambs).
  - 5. Operation: Manual and motorized, in locations indicated.
  - 6. Finish: Clear anodized.

#### **2.03 ACCESSORIES**

- A. Fascias: Size as required to conceal shade mounting.
  - 1. Style: As selected by Architect from shade manufacturer's full selection.
- B. Brackets and Mounting Hardware: As recommended by manufacturer for mounting configuration and span indicated.
- C. Fasteners: Non-corrosive, and as recommended by shade manufacturer.

#### **2.04 FABRICATION**

- A. Fabricate shades to fit openings within specified tolerances.
  - 1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
  - 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- B. Dimensional Tolerances: As recommended in writing by manufacturer.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Start of installation shall be considered acceptance of substrates.



### **3.02 PREPARATION**

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Installation Tolerances:
  - 1. Maximum Offset From Level: 1/16 inch.
- C. Adjust level, projection and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

### **3.04 CLEANING**

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

### **3.05 PROTECTION**

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**

## **SECTION 123600 COUNTERTOPS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 123553.19 - Wood Laboratory Casework: Laboratory countertops.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI A161.2 - Performance Standards for Fabricated High Pressure Decorative Laminate Countertops; 1998.
- B. ANSI A208.1 - American National Standard for Particleboard 2016.
- C. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2016.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2021a.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- F. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- G. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.
- H. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- I. PS 1 - Structural Plywood 2009 (Revised 2019).

#### **1.04 SUBMITTALS**

- A. See Section 013000 - 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. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
- F. Installation Instructions: Manufacturer's installation instructions and recommendations.
- G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

#### **1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Same fabricator as for cabinets on which tops are to be installed.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

#### **1.07 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

### **PART 2 PRODUCTS**

#### **2.01 COUNTERTOPS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

- B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
  - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
    - a. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    - b. Finish: Matte or suede, gloss rating of 5 to 20.
    - c. Surface Color and Pattern: As indicated on drawings.
    - d. Manufacturers:
      - 1) Basis of Design: Pionite & Wilsonart
      - 2) Substitutions: See Section 016000 - Product Requirements.
  - 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
  - 3. Back and End Splashes: Same material, same construction.
- C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch, minimum.
  - 2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    - a. Manufacturers: Basis of Design: Corian
      - 1) Dupont; Corian: [www.corian.com/#sle](http://www.corian.com/#sle).
      - 2) Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
      - 3) Substitutions: See Section 016000 - Product Requirements.
    - b. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124.
    - c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
    - d. Color and Pattern: As indicated on drawings.
  - 3. Other Components Thickness: 3/4 inch, minimum.
  - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
  - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
  - 6. Skirts: As indicated on drawings.

## 2.02 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

## 2.03 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  - 1. Join lengths of tops using best method recommended by manufacturer.
  - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  - 2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

1. Integral sinks: Shop-mount securely to countertop with adhesives, using flush configuration, as per manufacturer's instructions, and as detailed on drawings.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.03 INSTALLATION**

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

#### **3.04 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

#### **3.05 CLEANING**

- A. Clean countertops surfaces thoroughly.

#### **3.06 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 146000  
BRIDGE CRANES AND HOISTING EQUIPMENT**

**PART 1 – GENERAL**

**1.01 DESCRIPTION**

**A. SCOPE**

1. This section specifies bridge cranes and hoisting equipment.
2. Runway beams and rail are part of the building steel package and are not included in this section.

**B. CRANE SUMMARY**

**Crane #1 & #2**

Span:	50 Ft., 0 Inches
Capacity:	3 Ton (6,000 LB)
Crane type:	Under-running, single-girder, dual-motor
Classification:	Crane shall be designed and constructed to CMAA Specification # 70 or #74, as applicable, for Class "C" service requirements and operation in a non-hazardous environment.
Crane speed:	100 FPM, infinitely variable
Crane drive:	Dual motor drive
Trolley speed:	65 FPM, infinitely variable
Trolley drive:	Motorized
Hoist speeds:	20 and 3.2 FPM, two speed
Hoist type:	Electric wire rope
Hoist lift required:	20 Ft Min.
Control:	Pendant from independent track on bridge

**Base-Mount Jib Crane**

Model:	Abell-Howe J-904B-180
Span:	18'-0"
Boom Height:	12'-0"
Overall Height:	13'-6 1/8"
Footing Depth:	4'-0"
Footing Width:	8'-0"
Capacity:	2 Ton (4,000 LB)
Motor:	Electric Motor Drive
Voltage:	230/460-3-60 with 110V control.
Control Pendant:	Standard 8-button
Rotation:	360 degree
Festoon:	Messenger wire with power & control cable

**C. WORK INCLUDES THE FOLLOWING:**

1. Detailed design of completed crane system, including bridge, end trucks, trolley, hoists, cabling, controls, and all appurtenances specified hereinafter.
2. Shop drawings.
3. Fabrication of a complete crane.
4. Inspection and shop testing.
5. Documentation and schedules.

**1.02 REFERENCES**

Equipment furnished under this section shall, except as otherwise noted, comply in all respects with the requirements of the following standards:

OSHA            Occupational Safety and Health Administration  
Part 1926.554 - Overhead Hoists  
Part 1910.179 – Overhead and Gantry Cranes

\*CMAA Crane Manufacturer's Association of America  
Specifications for Top Running Bridge & Gantry Type Multiple  
Girder Electric Overhead Traveling Cranes - No. 70 (2015)  
Specifications for Top Running and Under Running Single Girder Electric  
Overhead Cranes Utilizing Under Running Trolley Hoist - No. 74 (2015)

\*ANSI / ASME  
American National Standards Institute /  
American Society of Mechanical Engineers  
ANSI / ASME HST-4 - 2016 Performance Standard for Overhead Electric  
Wire Rope Hoists  
ANSI / ASME B30.16 – 2017 Overhead Underhung and Stationary  
Hoists  
ANSI / ASME B30.2 - 2016 Overhead and Gantry Cranes  
(Top Running Bridge, Single or Multiple Girder, Top Running Trolley  
Hoist)  
ANSI / ASME B30.17 – 2015 Cranes and Monorails (with Underhung  
Trolley or Bridge)  
ANSI / ASME B30.30 – 2019 Ropes

NEMA            National Electric Manufacturers Association

NEC             National Electric Code – 2017  
Article 100, Article 240-1, Article 430-31, Article 430-51, Article 610-1,  
Article 610-31

\*Compliance to this standard is limited to the extent such standard is  
incorporated into and made mandatory by OSHA regulations.

### **1.03 SUBMITTALS**

#### **A. SHOP DRAWINGS AND EQUIPMENT DATA**

1. Manufacturer's catalog data for hoist.
2. Dimensional drawings and details for bridge crane system.
3. Wiring schematics. – ship with crane

#### **B. OPERATIONS AND MAINTENANCE MANUALS (one set of Owner's manuals in paper and on CD rom)**

1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, and maintenance instructions.
3. Lubrication and maintenance instructions.
4. Guide to "troubleshooting".
5. Parts list.
6. As-built drawing.
7. Test results.

#### 1.04 APPLICABLE STANDARDS

- A. Contractor shall adhere to OSHA, state, and local safety guidelines, laws, rules, and regulations.
- B. Contractor shall conform to all applicable ANSI, CMAA, and HMI specifications and/or standards.
- C. Comply with CMAA specification 74 or 70, as applicable.
- D. Long lead items [hoist, end trucks, drives and controls] will be ordered by contractor upon receipt of purchase order and credit approval. Steel will not be ordered until shop drawings and submittals have been approved by the customer.
- E. All electric equipment shall be UL, CSA c/us or ETL labeled.

#### 1.05 WARRANTIES

- A. Provide one-year equipment warranty.

### PART 2 - PRODUCTS

#### 2.01 ACCEPTABLE PRODUCTS

- A. Bridge crane package systems shall be provided by: Superior Crane Corp..
- B. Hoist shall be **R&M Spacemaster® SX** electric wire rope type.

#### 2.02 MATERIALS

<u>Components</u>	<u>Material</u>
Bridge beams	Steel, ASTM A36 or A992
End trucks	Steel, ASTM A36 (or equal)
Trolley	Steel, ASTM A36 (or equal)
Wheels	Cast iron or steel
Hooks	Forged steel

#### 2.03 EQUIPMENT

- A. HOIST AND TROLLEY
  - 1. Under-running single girder cranes shall utilize the Spacemaster® SX low headroom or standard headroom electric wire rope hoists as manufactured by R&M Materials Handling Inc., Springfield, OH.
  - 2. The hoist shall be equipped with an electro-mechanical load-limiting device that shall prevent lifting more than 110% of the rated load.
  - 3. Hoist and trolley motors shall be per 1.01B above, as applicable.
  - 4. Hoisting motor(s) shall be two-speed/two winding squirrel cage type with a speed ratio of 6:1.

5. Hoisting motor(s) shall be totally enclosed with IP55 protection, minimum class F insulation, Klaxon type bimetal switch for thermal protection and shall have a 60% ED rating.
6. Trolley shall be furnished with an adjustable frequency inverter drive and two-step or infinitely variable speed control for smooth acceleration and deceleration.
7. Trolley motors shall be inverter duty motors with minimum class "F" insulation and motor enclosures shall be TENV [totally enclosed non-ventilated].
8. Rotary cam type limit switch equipped with 4 micro-switches shall be provided. Limit switch shall provide upper and lower limit of hoist travel, hoist slow down prior to reaching upper limit and phase sequence supervision at upper limit. An additional block operated limit shall be included.
9. Hoist motor brake shall be DC disc type with adequate torque to stop and hold over **125%** of the hoist rated load.
10. Large diameter rope drum with a minimum of 36:1 drum to wire rope diameter ratio. Groove depth shall be at least 35% of rope diameter. The rope drum shall be equipped with a rope guide to help keep the rope aligned in the grooves of the drum.
11. Wire rope shall be constructed from galvanized steel having a minimum safety factor of 5.
12. Hoist reeving shall be single reeved. Lateral hook drift shall not exceed 1/8 inch per foot of vertical travel on single reeved models.
13. The hoist nameplate is to carry a CSA c/us rating. The actual hoist control enclosure rating shall be at least equivalent to IP55 / NEMA 4 type.
14. Hooks shall be made of forged alloy steel (34CrMo4QT or 34CrNiMo6QT) and shall be fitted with a spring-loaded flipper-type safety latch.
15. Hoist shall have a duty rating suitable for the load class and load cycles of the application (reference appendix A).
16. AGMA quality class 12 machine cut, hardened and precision ground hoist gearing. The gears inside the hoist gearboxes on models up to 5 ton capacity are lubricated by semi-fluid grease. On models over 5 ton capacity the gears inside the hoist gearbox are lubricated with semi-fluid grease or oil.
17. AGMA quality class 10, hardened and precision ground trolley drive gearing, lubricated by semi-fluid grease.
18. Trolleys shall have safety drop lugs and energy absorbing bumpers.

#### B. BRIDGE GIRDER

1. Bridge girder shall be per 1.01B above, as applicable.
2. Bridge girders shall be constructed from welded box girders or Structural beams, Steel, ASTM A36 or A992, as required.



C. END TRUCKS AND BRIDGE DRIVE

1. End trucks shall be designed in accordance with CMAA specifications as applicable (reference appendix B).
2. End trucks shall be bolted to bridge girder.
3. Bridge drive shall be dual-motor (A-4 arrangement per CMAA).
4. Bridge drive shall be designed to stop the bridge within CMAA specifications.
5. End trucks shall be equipped with rail sweeps and energy-absorbing rubber bumpers.
6. Travel limit switches to be provided as necessary for safe operation.
7. Bridge shall be furnished with an adjustable frequency inverter drive and two-step or infinitely variable speed control for smooth acceleration and deceleration.
8. Bridge motors shall be inverter duty motors with minimum class "F" insulation and motor enclosures shall be TENV [totally enclosed non-ventilated].
9. AGMA quality class 10, hardened and precision ground bridge drive gearing, lubricated by semi-fluid grease.

D. POWER SUPPLY

1. Power supply for the hoist shall be \_\_\_\_\_ volt, 3 ph., 60 Hz. All power required for the operation of the hoist, trolley, and end trucks shall be developed from this source.
2. Runway electrification shall be 4-bar safety type rigid conductors as manufactured by Insul-8, Duct-O-Wire Company or Wampfler. Wall mounted disconnect switch and power to runway conductors provided by Electrical Contractor.
3. Cross bridge electrification shall be flat cable style festoon system with terminal box, multi-conductor cord, plug connectors (when available) and accessories. Cables are to be hardwired when plug connectors are not available.

E. CONTROLS

The following controls shall be used as applicable:

1. Six-way operation, plug-in pushbutton pendant suspended from independent festoon track. Radio control may be quoted as an option.
2. Pendant shall include Start (momentary) button and Emergency Stop (push to maintain, turn to release) that controls a mainline contactor in the bridge control panel.

3. Pushbutton shall be clearly marked with hoist, trolley and bridge travel directions.
4. Hoist shall be 2 speed magnetic reversing type (standard) or variable frequency inverter control (optional) and the trolley and bridge controls shall be variable frequency inverter control (standard), as required per section 1.01.B.
5. Electrical control enclosures shall be IP55 or NEMA 4 type. Pushbutton enclosure shall have a rating of IP65, NEMA 4X, 4 or 5.

**F. LABELING**

1. Hoist and bridge beam shall be labeled with load rating.
2. A corrosion-resistant nameplate shall be fixed to the bridge with the following information:
  - a. Name of manufacturer
  - b. Mfg.'s model number and serial number
  - c. Capacity
  - d. Date of manufacture (month and year)

**G. PAINTING**

1. Hoist and trolley shall be factory painted (2-part epoxy) per manufacturer's standards.
2. Bridge shall be shop cleaned, primed, and painted per manufacturer's standards.
3. The following items shall not be painted:
  - a. Rail surfaces in contact with wheels
  - b. Wheel running surfaces
  - c. Hoist wire rope
  - d. Conductor bar, festoon cables and supports

**PART 3 – EXECUTION**

**3.01 INSTALLATION AND INSPECTION**

- A. Inspect structure and crane rail erection for conformance with reviewed shop drawings and contract documents prior to installation of equipment. Bring nonconforming work to the attention of the customer prior to proceeding with crane installation. Non-conforming runway structure or installation must be corrected prior to load testing of crane system. Costs of delays or additional work due to nonconforming runway structure will be reimbursed by the Owner.
- B. Bridge crane shall be installed in conformance with manufacturer's instructions and inspected by a manufacturer's representative. Provide all necessary accessories to make bridge crane complete, usable, and capable of meeting the operating requirements specified in the Operating Requirements. Test, adjust and clean equipment for acceptance by Owner.

### **3.02 TESTING**

- A. All crane equipment shall be operated through a complete lift and lowering cycle and through a complete travel of the bridge and trolley to determine that the equipment shall perform smoothly and safely, and that pendant cable length is sufficient to permit operation from desired floor levels. All tests shall be carried out with the bridge crane equipment loaded at 125 percent of capacity. The bridge crane provider shall provide the test weight loads. Any defects shall be corrected by the bridge crane provider without any expense to the Owner.

### **3.03 USE BY CONTRACTOR**

- A. If crane is used by the Contractor, it shall be repaired, repainted, and otherwise refurbished to like new condition prior to its acceptance. The Contractor assumes all responsibility for operation and maintenance until the crane has been accepted by Owner.

### **3.04 CLEANUP**

- A. Upon completion of work, area shall be cleaned and restored to original condition, acceptable to the Owner.

**END OF SECTION**

Table of Contents

Division .....	Section Title .....	Pages
----------------	---------------------	-------

**DIVISION 21 – FIRE PROTECTION**

21 1000 .....	Fire Suppression Systems .....	10
---------------	--------------------------------	----

**DIVISION 22 - PLUMBING**

22 0500 .....	General Plumbing Requirements .....	6
22 0510 .....	Basic Plumbing Materials and Methods .....	6
22 0700 .....	Plumbing Systems Insulation .....	4
22 4000 .....	Plumbing .....	5

**DIVISION 23 – HEATING, VENTILATION AND AIR CONDITIONING**

23 0500 .....	General HVAC Requirements .....	7
23 0510 .....	Basic HVAC Materials and Methods .....	4
23 0593 .....	Testing, Adjusting, and Balancing (Air & Water) .....	3
23 0700 .....	HVAC Systems Insulation .....	5
23 0900 .....	Controls & Control Sequences .....	15
23 2113 .....	Hydronic Piping Systems .....	14
23 2123 .....	HVAC Hydronic Pumps .....	4
23 7000 .....	Ventilation and Air Conditioning .....	16

FIRE PROTECTION WORK SHALL INCLUDE:  
SECTION 21 1000

PLUMBING, & HYDRONICS WORK SHALL INCLUDE:  
SECTION 22 4000, 23 2113, & 23 2123  
& SECTIONS 22 0500, 22 0510, 22 0700, 23 0500, 23 0510, & 23 0700 AS APPLIES

VENTILATION AND AIR CONDITIONING WORK SHALL INCLUDE:  
SECTION 23 0593, 23 0900, & 23 7000  
& SECTIONS 23 0500, 23 0510 & 23 0700 AS APPLIES



**SECTION 21 1000**  
**FIRE SUPPRESSION SYSTEMS**

**PART 1 GENERAL**

**1.01 DEFINITIONS**

- A. Contractor – Defined as the Contractor, Subcontractor and/or Subcontractors which are responsible for all or any part of the fire suppression system installation specified in Division 21 and/or as shown on the Contract Drawings.
- B. Wet Pipe Sprinkler System – A system in which automatic sprinklers are attached to piping filled with water allowing water to discharge immediately from sprinklers when activated. Sprinklers activate when heat bursts a frangible glass bulb or melts a fusible link. System activation or incidental flow is monitored by flow switches and/or alarm valves. Hose connections are included when required by code.
- C. Dry Pipe Sprinkler System – A system in which automatic sprinklers are attached to piping filled with compressed air until the event that heat from a fire activates a sprinkler by bursting a frangible glass bulb or melting a fusible link. Air that escapes through the activated sprinkler will cause air pressure loss in the system signaling the dry valve to open then delivering water to the piping and corresponding sprinklers. System activation or incidental flow is monitored by pressure switches, flow switches and/or alarm valves.

**1.02 SCOPE**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 shall apply to this section.
- B. Where any requirements specified on the plans conflict with the specifications of this section, the specifications indicated on the plans shall govern.
- C. The Contractor shall provide all items, articles, materials, operations or methods listed, mentioned or scheduled on the Drawings and/or herein specified, including all labor, materials, equipment, accessories, wiring and incidentals necessary to be installed in accordance with manufacturer's recommendations except as otherwise approved.
- D. The fire protection system for the shop addition shall be a wet-pipe system consisting of a single zone as defined by the plans. An additional zone control valve assembly for the shop addition shall be added to the existing manifold located in the existing Mechanical 143 room. The wash bay addition shall be protected thru the extension of the existing wet pipe system located in the adjacent existing shop space to the north. The classroom addition shall be protected through the extension of the existing adjacent wet pipe system. Other small office, restroom and storage remodel spaces at various locations within the existing building shall be protected by remodeling the existing wet pipe systems that are located within. The systems in office, restroom, and classroom areas shall be designed for light hazardous classification. The storage and shop areas shall be designed for ordinary hazard, group 2 classification. System(s) will be supplied by an existing 6" underground dedicated fire sprinkler service located in existing Mechanical 143. The system(s) shall be complete with, but not limited to, sprinklers, piping, valves, alarm bell/horn, fire department connection, backflow preventer test connection, and controls necessary for a complete system.
- E. Systems are/will be supplied by an 6" underground dedicated fire sprinkler service located in Mechanical Room 143.
- F. The system(s) shall be complete with, but not limited to, sprinklers, piping, valves, alarm bell/horn, fire department connection, backflow preventer test connection, and controls necessary for a complete system.
- G. See the plans for water supply flow test information.

### **1.03 CONTRACTOR QUALIFICATIONS**

- A. The Contractor for the fire protection installation shall be a qualified Fire Protection Contractor licensed in the State of South Dakota that has been regularly engaged in the installation of similar Automatic Fire Sprinkler Systems and associated fire protection equipment for a minimum of 5 years.

### **1.04 PERMITS AND SERVICE CHARGES**

- A. All permits and service charges necessary for execution of the work under this Contract shall be obtained by and paid for by the Contractor. It shall be the responsibility of the Contractor to determine the permit requirements of the local authorities and utility companies and the cost of required permits, service charges, tap fees and development fees shall be included in the Contractor's bid.
- B. All work shall be executed in accordance with all local, state and national rules, regulations, codes, etc., which are applicable and shall be subject to inspection by the proper authorities.

### **1.05 CODES AND STANDARDS**

- A. All work performed and all equipment furnished under this Division of the Contract shall be manufactured and installed in strict accordance with the most recent editions of all applicable codes and standards, including the applicable provisions of the following codes and standards:
  - 1. Local and State Codes, Standards and Regulations
  - 2. National Fire Protection Association (NFPA)
    - a. NFPA 13 –Installation of Sprinkler Systems
    - b. NFPA 25 – Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
  - 3. National Electric Code (NEC) (NFPA 70)
  - 4. International Fire Code (IFC)
  - 5. Underwriter's Laboratory (UL)
  - 6. Uniform Plumbing Code
  - 7. International Mechanical Code
  - 8. American Waterworks Association (AWWA)
  - 9. Williams-Steiger Occupational Safety and Health Act of 1970 (OSHA)
  - 10. International Building Code
  - 11. Americans with Disabilities Act (ADA)
- B. Where specific requirements of any code vary with the requirements of another code, the higher standard as determined by the Architect/Engineer shall govern the installation.
- C. All equipment manufactured in accordance with the provisions of the above codes and standards shall bear the label of the respective association bureau thereon.
- D. All materials installed shall have composite fire and smoke hazard ratings as tested by procedures ASTM 84, NFPA 255 and UL 723 not to exceed 25 Flame Spread and 50 Smoke Developed.

### **1.06 AUTHORITIES AND AGENCIES**

- A. All work will be installed for the approval and acceptance of the following:
  - 1. South Dakota Office of the State Engineer
  - 2. Owner's Insurance Company
  - 3. Fire Protection Engineer

### **1.07 DRAWINGS**

- A. In general, the Drawings of the fire protection systems and equipment are to scale. However, to determine exact locations of walls and partitions, the Contractor shall consult the architectural and/or structural drawings which are dimensioned. Drawings shall not take precedence over field measurements.
- B. Drawings of piping and sprinklers, although shown on scale drawings, are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location

and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail or exact arrangement of construction. If it is found, before installation of any or all construction phases, that a more convenient, suitable or workable arrangement of any or all phases of the project would result by varying or altering the arrangement indicated on the Drawings, the Architect/Engineer may require the Contractor to change the location or arrangement of the work without additional cost to the Owner. Such rearrangement shall be in accordance with directions from the Architect/Engineer.

- C. Where discrepancies are discovered after certain portions or phases of the work have been installed, the Architect/Engineer reserves the right to require the Contractor to make changes in pipe, duct, fixture or equipment locations or arrangements to avoid conflicts with work at no additional cost to the Owner.
- D. Because the Drawings are to a relatively small scale to show as large a portion as is practical, the fact that only certain features of the system are indicated does not mean that other similar or different features or details will not be required. The Contractor shall furnish all incidental labor, material or equipment for the systems so that each system is a complete and operating one unless otherwise specifically stipulated in the detailed body of the specifications.
- E. The Contractor, Subcontractor's and their respective trades shall cooperate in laying out their work so it will fit properly into the space provided. Promptly report to the Architect/Engineer any delay or difficulties encountered in the installation of this work which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of others. Failure to so report shall constitute an acceptance of the work of other trades as being fit and proper for the execution of this work.

#### **1.08 SHOP DRAWINGS**

- A. Shop drawings to be submitted in electronic PDF format unless indicated otherwise in the General Conditions.
- B. To the extent practical, complete sets of shop drawings for each specification section shall be submitted. In the case that a particular item is required to be expedited, that particular item may be submitted individually.
- C. Submit shop drawings in electronic PDF format.
- D. Furnish Shop Drawings as follows:
  - 1. For all major items of equipment or materials, regardless of whether the item is to be furnished as specified.
  - 2. For all equipment, systems or devices where Shop Drawings are specifically called for.
  - 3. For all minor items of equipment or materials where the Contractor proposes to deviate from the specified and/or scheduled manufacturer or material.
- E. Shop Drawings will be reviewed by the Architect/Engineer, a review letter will be returned to the Contractor. Shop Drawings shall be submitted sufficiently in advance of the construction schedule to allow time for checking Drawings, resubmittal and rechecking when necessary.
- F. Shop Drawings will be reviewed by the Architect/Engineer, and copies of Shop Drawings will be returned to the Contractor. Shop Drawings shall be submitted sufficiently in advance of the construction schedule to allow time for checking Drawings, resubmittal and rechecking when necessary.
- G. Any equipment or material which is installed without authorization by properly processed Shop Drawings will be subject to removal by the Contractor and reinstallation as directed, without cost to the Owner. All cost for repair for damages as may be incurred to the structure as a result of the above correction shall be paid by this Contractor.
- H. Shop drawing material quantities will not be checked by the Architect/Engineer, and review of Shop Drawings by the Architect/Engineer shall not be construed to be verification of the material quantities and sizes shown on the Shop Drawings. Quantities, sizes, dimensions and locations shown on the Drawings and as specified shall determine material requirements.



- I. Hydraulic calculations proving the system is capable of providing the required design densities to accommodate the use and occupancy of each shall be performed by the contractor. The contractor is required to perform and submit hydraulic calculations as part of their submittal packages.

#### **1.09 COORDINATION**

- A. The Contractor shall communicate with all other Contractors on this project and shall arrange his work in proper relation to the work of others. Work made necessary as a result of failure to coordinate with other Contractors shall be the responsibility of this contractor and shall first be approved by the Architect/Engineer. The contractor shall coordinate with the General Contractor to maximize the efficiency of the onsite placement and to ensure the safe delivery and storage of the materials.

#### **1.10 EXISTING SERVICES**

- A. The Contractor shall verify the exact location of all existing building services extended and/or relocated for this project. The Contractor shall also verify the exact location and take proper precautions to protect all services which may be encountered during construction.
- B. All active services which are encountered shall be protected, braced and supported where required for proper execution of the work and without interruption of the service if possible.
- C. All inactive services which are encountered shall be protected or removed as directed by the Architect/Engineer, Owner, Utility Company or Municipal Agency having jurisdiction. The service shall also be plugged or capped as directed.
- D. When active services must be temporarily interrupted, the interruption shall be scheduled at night or at such time as approved by the Owner or authority having jurisdiction and so as to cause the minimum of interference with establishing operating routine. Arrangements shall be made to work continuously including overtime if required, to assure that services will be interrupted only as long as actually required to complete necessary work.

#### **1.11 CLEANING**

- A. The Contractor and/or Subcontractors for the various phases of the work shall clear away all debris, surplus materials, etc., resulting from their work or operations, leaving the job and equipment furnished under any or all contracts in a clean first class condition.

#### **1.12 PAINTING**

- A. Painting of materials and equipment furnished shall be as described in DIVISION 9. Contractor shall refinish and restore to the original condition and appearance, all equipment which has sustained damage to the manufacturer's prime and finish coats of enamel or paint. Materials and workmanship shall be equal to the requirements described in DIVISION 9.
- B. Where sprinklers are installed on exposed piping and in other locations where sprinklers are susceptible to paint spray or over-spray, contractor shall cover sprinklers in preparation for painting.

#### **1.13 ACCESS TO EQUIPMENT**

- A. Access shall be provided to all motors, valves, controls, specialties, etc., for maintenance purposes. All access doors, access panels, removable sections, etc., required for access shall be provided. The location of the access openings relative to the equipment shall be coordinated to assure proper access to the equipment. The door shall maintain any ratings of the wall, ceiling, etc. that it penetrates.
- B. Access openings are required for valves and other devices requiring access and shall be provided in the housings, tanks, walls, ceilings, etc., under this portion of the Contract.

#### **1.14 INSPECTIONS, TESTING, CERTIFICATES, & WARRANTY**

- A. All inspections, examinations and tests required by the authorities and agencies specified shall be arranged and paid for by the Fire Protection Contractor as necessary, to obtain complete and final acceptance of the Fire Protection System per the requirements of NFPA 13 and any

other applicable codes. The Contractor shall provide a minimum 1 year warranty on the system effective starting the day of final system acceptance and also at that time be required to provide instruction to the owner or his representative to acquaint that person thoroughly with all system equipment.

- B. After completion of the fire protection installation and at the start of the guarantee year, the Fire Protection Contractor shall execute and file five (5) copies of the "Contractor's Material and Test Certificate, Sprinkler systems - Water Spray Systems" with the Architect/Engineer.

#### **1.15 RECORD DRAWINGS**

- A. The Contractor shall keep a complete set of all drawings in the jobsite office for purpose of showing the installation of mechanical systems and equipment. This set of drawings shall be used for no other purpose. Where any equipment or system components are installed different from that shown on the Architect/Engineer's drawings, such differences shall be clearly and neatly shown on this set of drawings using ink or indelible pencil. At the completion of the project, the record set of drawings shall be turned over to the Architect/Engineer and shall become his property. Record drawings may be inspected by the Architect/Engineer at site visits.

#### **1.16 OPERATING INSTRUCTIONS**

- A. The Contractor shall furnish the Owner two (2) sets of complete catalog data, manufacturer's literature and detailed manuals covering the operation and maintenance of all equipment specified under this Section. All such literature shall be bound in an amply sized three-ring binder and submitted to the Architect/Engineer for approval and for eventual transmittal to the Owner. The manual shall have a Table of Contents at the front of the manual. In addition to a hard copy of the operating instruction, provide an electronic copy in PDF format to the Owner.
- B. The Contractor shall also supervise the initial operation of all equipment and instruct the operator selected by the Owner in such operation as required to acquaint him thoroughly with the equipment.

### **PART 2 - PRODUCTS**

#### **2.01 PRODUCT OPTIONS**

- A. Materials or equipment specified by name of manufacturer, brand, trade name or catalog reference, shall be furnished under the contract unless changed by Addenda or a Contract modification.
- B. Where two (2) or more materials are named, the choice of these shall be limited to the items named. Where the material or equipment named is followed by the phrase "or equal" the required function, dimension, appearance and quality to be met by any proposed substitute is all that is intended to be established.
- C. Proposed substitutions for any named items shall be submitted to the Fire Protection Engineer for approval. No substitution shall be made without the approval of the Fire Protection Engineer. Any proposed substitution requests shall be submitted at least 10 days prior to bid to the Architect/Engineer for approval. Bidders shall not rely upon substitutions made in any other manner.
- D. Should a proposed substitution wish to be made within 10 days of bid the Contractor shall attach his proposed substitution along with the appropriate add or deduct to the Contract amount, should the substitution be accepted. Substitutions proposed by the Contractor will not be considered in the award of the Contract.
- E. All products shall be new and listed for fire protection use and be rated in excess of the maximum expected pressure that will be present in the systems.

#### **2.02 SPRINKLERS**

- A. Except where designated otherwise on the drawings, sprinklers shall be as follows:
  - 1. Sprinklers shall be standard semi-recessed white-plated pendant type in all locations where piping is concealed above ceilings.

2. Sprinklers shall be standard upright type where piping is installed exposed in storage, garage and other locations as indicated on the Drawings. Upright sprinklers shall be plain brass finish.
  3. Sidewall sprinklers, where permitted, shall be white-plated semi-recessed in finished rooms, plain brass elsewhere.
- B. Temperature rating of sprinklers shall be in accordance with requirements of approving authorities, as noted on the Drawings, and per the requirements of NFPA 13.
  - C. Sprinklers shall be installed centered in square ceiling tile and in the narrow dimension of rectangular ceiling tile. In rectangular tiles sprinklers shall be centered or at the quarter points along the longer dimension of the tile.
  - D. Sprinklers installed in areas where damage may occur, such as gymnasiums, shall have head guards and as otherwise designated on the drawings. Sprinklers installed at elevations below 7'-0" shall have head guards.
  - E. Concealed brass sprinklers with flush white-plated concealer plate shall be installed where noted on the Drawings. Sprinklers shall be Tyco, Reliable, Victaulic, Viking, or equal.

## **2.03 ESCUTCHEONS**

- A. Escutcheons shall be installed as designated on the drawings and shall be the same make as the sprinkler head that is used.
- B. Escutcheons shall be Tyco, Reliable, Victaulic, Viking, or equal.

## **2.04 PIPE AND PIPE FITTINGS**

- A. Furnish and install where shown on the Drawings and required for a complete system, pipe and fittings of type and material for the various services as noted below.
- B. Piping not shown on the Drawings, which is obviously necessary for complete systems, shall be provided and shall be amply sized in accordance with applicable codes and standards.
- C. Wet fire sprinkler system (water-filled) and deluge system (open-type) piping shall be ASTM A-135 standard-weight, black, Schedule 40 with factory or field formed threaded ends for sizes up to 2 inch size. Fittings used on threaded end piping shall be ASME B16.3 Class 150, ductile iron threaded fittings with NPT threads that conform to ANSI B1.20.1. Wet fire sprinkler piping shall be ASTM A-135 Schedule 10, black with factory or field formed roll-grooved ends for sizes 1-1/4" and greater. Grooved fittings shall be standard or short radius ASTM A-536, Grade 65-45-12, ductile iron fittings with cut-grooved ends and non-lead orange enamel coated. Grooved couplings shall include ductile iron, ASTM A-536, Grade 65-45-12, housings with non-lead orange enamel coatings, ASTM A-449 and ASTM A-183 bolts and nuts, and Grade "E" EPDM Type A gaskets. Grooved pipe outlets shall be tee-let, ASTM A-53, ANSI B1.20.1 threaded or cut groove, factory welded outlet fittings. Field installed outlets shall be permitted to be mechanical "T", bolted, ASTM A-536, orange enamel coated ductile iron, with ANSI B1.20.1 threaded or cut groove outlets, Grade "E" EPDM gaskets, and ASTM A-449 and ASTM A-183 bolts and nuts.
- D. Dry fire sprinkler system (compressed air-filled) piping and drain piping shall be ASTM A-135 standard-weight, Schedule 40 with factory or field formed threaded ends for sizes up to 2 inch size. Fittings used on threaded end piping shall be ASME B16.3 Class 150 ductile iron threaded fittings with NPT threads that conform to ANSI B1.20.1. Dry fire sprinkler piping shall be ASTM A-135 Schedule 40 standard-weight with factory or field formed roll-grooved ends for sizes 1-1/4" and greater. Grooved fittings shall be standard or short radius ASTM A-536, Grade 65-45-12, ductile iron fittings with cut-grooved ends. Grooved couplings shall include ductile iron, ASTM A-536, Grade 65-45-12, housings, ASTM A-449 and ASTM A-183 bolts and nuts, and Grade "E" EPDM gaskets. Grooved pipe outlets shall be tee-let, ASTM A-53 ductile iron, and ANSI B1.20.1 threaded or cut groove factory welded outlet fittings. Factory or field installed outlets shall be permitted to be mechanical "T", bolted, ASTM A-536 ductile iron, ASTM A-153, with ANSI B1.20.1 threaded or cut groove outlets, Grade "E" EPDM gaskets, and ASTM A-449 and ASTM A-183 bolts and nuts.

- E. All piping that penetrates an exterior wall shall be galvanized Schedule 40 minimum.
- F. Pipe and Fittings shall be hot-dipped galvanized in Wash Bay 968.
- G. Plastic CPVC Schedule 80 piping and fittings are not allowed for this installation.
- H. Copper piping shall be installed where designated on the drawings and as per its listing. Copper piping shall be soldered when installed concealed and brazed when installed exposed. Piping shall be Type M Mueller, Cerro, or equal.
- I. Flexible piping is allowed for this project where approved by its listing.
- J. All wet and dry system grooved pipe fittings and couplings shall be Victaulic, Anvil Gruvlok, Tyco, Star or equal. Grooved pipe fittings and couplings shall be ductile iron with an orange enamel coating for wet systems and galvanized coating for dry systems. All components shall be supplied by one manufacturer. Pipe fittings and couplings shall be standard or short radius.
- K. All threaded fittings shall be black ductile iron for wet systems and where otherwise required by the drawings. All dry system threaded fittings shall be galvanized ductile iron. Threaded fittings shall be supplied by Tyco, Star, Anvil, or equal.
- L. All welded outlet fittings shall be Merit, Island, or equal.
- M. All flanged fittings shall be ductile iron per ASTM A536. Flanged fittings shall be Anvil, Star, or equal.
- N. Plastic CPVC fittings are not allowed for this installation.
- O. Copper fittings shall be installed where designated on the drawings and as per its listing.
- P. All pipe ends shall be smooth and burr free and cleaned of any loose debris or pipe hole cutouts prior to installation.

## **2.05 HANGERS AND ATTACHMENTS**

- A. All piping 1/2" through 8" shall be hung through the use of galvanized ring style band hangers with a knurled swivel nut. Hangers, spacing, and rod diameters shall be per NFPA 13 requirements.
- B. 3/8" all thread rod shall be used to attach the ring to the structural attachment device for pipe sizes 1/2" through 4", 1/2" all thread rod shall be used for pipe sizes 6" through 8", and 5/8" all thread rod shall be used for pipe sizes 10" through 12".
- C. Rings shall be Tolco, Hilti, Anvil, or equal.
- D. Structural Attachments shall be Sammy, Tolco, Hilti, or equal.

## **2.06 FIRESTOPPING**

- A. Firestopping materials shall be 3M, Hilti, MetaCaulk, Nelson or equal. Firestopping material shall have a rating resistance rating equal to or greater than the wall in the penetration exists that will be sealed with said firestopping.

## **2.07 WALL, FLOOR AND CEILING PLATES**

- A. Furnish and install chrome-plated wall, floor and ceiling plates on all exposed pipes where they pass through walls, floors, or ceilings in finished areas. Finished areas shall be those areas which are painted or have special finishes within the room. The wall plates shall be a minimum of 3/32 inch thickness and shall have set screws or spring locks for clamping to the piping. Flush valves shall have set screw type wall plates. The plates shall be chrome-plated steel, cast iron or brass and shall set tight against the wall.

## **2.08 CONTROL VALVES**

- A. All valves shall be new and listed for fire protection use.
- B. Furnish and install valves in piping where so indicated on the Drawings.
- C. Of the several manufacturers listed, the Contractor is to standardize on one make as much as practical but not to the extent of sacrificing quality listed. Valves shall be Tyco, Milwaukee, Victaulic, Ames, Watts, Wilkins, or equal.

- D. Butterfly valves shall be of the indicating type with two sets of factory installed internal supervisory switches. Valves shall be ductile iron conforming to ASTM A-395 with Grade EPDM "E" encapsulated rubber disc seals. Valves shall be Tyco, Victaulic, or Equal.
- E. Outside Screw and Yoke (OS&Y) gate valves shall be ductile iron, raised face with bolted bonnets. Valve shall be Kennedy, Mueller, Nibco, Watts, or equal.
- F. Ball Valves 1-1/2" and smaller shall be standard port, end entry valves with a brass valve body. The ball shall be chrome plated brass with a stainless steel stem. Valves shall be Watts, Nibco, Milwaukee, Victaulic, or equal.

## **2.09 RISER MANIFOLDS**

- A. Riser manifolds shall be provided for each wet zone designated on the drawings. The manifold shall include a 300 psi water gauge, water flow alarm switch with paddle, Schedule 40 pipe body, ductile iron angle valve with site glass, and pressure relief valve.
- B. Riser manifolds shall be Tyco, Viking, Reliable, or equal.

## **2.10 AUTOMATIC AIR VENT**

- A. Furnish and install an automatic air vent for each wet zone. Automatic air vent shall be located near a high point in the wet system that allows for the maximum amount of air removal from that system. Automatic air vent shall have a minimum connection size of 1/2" and a minimum pressure rating of 175 psi.
- B. The device shall meet the requirements of UL 2573.
- C. Automatic air vent shall be Tyco, Viking, Reliable, or equal.

## **2.11 PRESSURE GAUGES**

- A. Furnish and install U.S. Gauge Model 5105 or equal pressure gauges in pipelines and on equipment as indicated herein and/or where shown on the Drawings. Gauges shall have phosphor bronze bourdon tube with brass movement.
- B. Gauges shall be compound, pressure or vacuum as required with 4-1/2 inch diameter dial. Each gauge shall be complete with Trerice No. 872 pressure snubbers, and brass ball valves.
- C. The normal operating pressure of each gauge shall be 50-70 percent of full scale. The range of the scale shall be suitable for the application.
- D. The gauges shall be located and mounted such that they can be conveniently read by a person standing on the equipment room floor. Accuracy shall be Grade "A". Case shall be aluminum.
- E. Pressure gauges shall be U.S. Gauge, Trerice, Weksler, Ashcroft, Weiss or equal.

## **2.12 AIR MAINTENANCE DEVICE**

- A. Air maintenance device shall be Tyco model AMD-1 or equal.
- B. Device shall be of the pressure reducing type with Field Adjustable Pressure Regulator.

# **PART 3 - EXECUTION**

## **3.01 PIPING CONNECTIONS**

- A. Pipe connection shall be through the use of grooved couplings attached to roll or cut grooves on the piping, female threaded fittings screwed on to threaded end pipe, and flanged fittings with bolts, nuts and rubber gaskets. Mechanical joint couplings may be used only with the approval of the Fire Protection Engineer.

## **3.02 PIPE HANGERS, SUPPORTS AND ANCHORS**

- A. Anchors and other attachments to the building structure shall be installed where designated and as detailed on the Drawings and specified herein and/or as required. The hangers shall adequately support the piping system. They shall be located near or at changes in piping direction and as otherwise required by NFPA 13. They shall provide vertical adjustment to maintain pitch required for proper drainage. They shall allow for expansion and contraction of the piping. Hangers shall bear directly on piping.

- B. Pipe hangers shall not be attached to the roof deck. Hangers shall be attached to the structure with beam clamps, beam attachment and brackets bolted to joists and beams, wood lag bolts, steel self tapping screws, and any other approved means of attachment that is rated to support five times the weight of the water filled pipe plus 250 lbs of additional load.
- C. Hanging from one pipe to another is prohibited.

### **3.03 PIPING INSTALLATION**

- A. All pipes shall be round and straight, of required size. Cutting shall be done with proper tools and pipes shall be reamed to full size after cutting.
- B. Piping shall be properly enclosed, supported, guided, anchored, sway braced, connected, tested, cleaned and flushed out and shall be properly insulated and protected where required.
- C. All pipes shall be run with proper grade to provide for easy draining and in group runs where applicable and in a neat and orderly manner, to the satisfaction of the Architect/Engineer. Lines required to be enclosed in ceiling, chase ways or similar spaces shall be installed to permit such enclosure as intended. All pipe runs shall be carefully laid out and scheduled to avoid necessary interferences with other work. If shown, pipe sizes on the Drawings are nominal pipe sizes and not outside diameters.
- D. Pipes shall be run substantially as indicated on the Drawings. However, the Architect/Engineer reserves the right to require this Contractor to make changes in pipe locations where conflicts occur with other trades. Such changes shall be made without extra cost to the Owner.
- E. Piping shall be installed with ample provisions for expansion and contraction to prevent injury to the same and to the building construction. Such provision shall be made by means of piping offsets, changes in direction, expansion loops and/or suitable expansion joints. Suitable anchors and guides shall be provided to permit proper deflection and compression of offset loops and expansion joints. Expansion joints shall not be used in lieu of offsets, changes in direction or loops, except where specified and/or indicated on the Drawings or where otherwise obviously necessary.
- F. Exposed piping shall be installed in a sanitary manner for ease in cleaning. Pipe shall be cut and threaded to fit the installation. Wherever possible, rough-in exposed pipe connections at the wall rather than the floor for ease in cleaning.

### **3.04 SLEEVES**

- A. Any pipe passing through building construction including walls, floors, roofs or masonry partitions or as noted on the Drawings shall be encompassed with sleeves. Piping passing through any fire rated barrier, walls, or floor shall be installed as follows:
  - 1. Sleeves shall have an inside diameter 1/2 inch greater than the outside diameter of pipe passing through. All sleeves shall be fabricated from new Schedule 40 steel pipe material cut square and reamed.
  - 2. Sleeves shall be provided in all masonry partition walls including locations above suspended ceilings where masonry partition walls extend from floor slab to slab above. Sleeves shall be Schedule 40 steel pipe finishing flush with the wall surface.
  - 3. Sleeves through exterior building walls shall be Schedule 40 steel pipe with welded flange in the middle of the sleeve and ends finishing flush with finished surfaces. Space between pipe and sleeve shall be packed to provide a watertight joint.
  - 4. Sleeves through roof slabs and floor slabs in concealed locations shall be Schedule 40 galvanized steel or linear polyethylene. Concealed sleeves shall be considered as pipe sleeves in shafts, pipe chases and within walls and partitions.
  - 5. Sleeves through floor slabs in exposed areas shall be Schedule 40 steel pipe and sleeves shall extend 1/4 inch above the finished floor surface. For slabs in equipment rooms and in other wet areas, sleeves shall be Schedule 40 steel pipe and shall extend 2 inches above finished floor surface.
  - 6. Floor sleeves in membraned floors shall be furnished with flashing rings and clamps.
  - 7. All sleeves in exposed locations, except equipment rooms, shall be set so plates specified will cover the sleeves.

8. All pipe sleeves where wet conditions exist, except sleeves through exterior walls, shall be caulked with a plastic caulking, including sleeves in concealed locations. The space between the pipe and the sleeves shall be caulked in both ends of sleeve, even with the ends of the sleeve. The sealer shall be suitable for temperatures from minus 50 degrees to 300 degrees, suitable for painting, non-corrosive and have good adhesion.
- B. Sleeves in fire rated construction, equipment rooms, and/or where designated on the Drawings shall consist of schedule 40 steel pipe. Seal sleeves with a fire retardant sealant. When applied according to manufacturer's recommendations, sealant shall have a 3-hour U.L. fire rating.
- C. All sleeves shall be set and maintained in place by this Contractor during the progress of the work. This Contractor shall be responsible for locating all sleeves at the proper location.
- D. Sleeves are not required for core drilled masonry wall and floor holes, masonry wall and floor holes formed by polyethylene plastic (removable) sleeves, or for masonry holes made in another neat manner except in equipment rooms and other wet areas.
- E. Sleeves are not required in metal or wood stud wall construction. Rated systems shall be provided as required to provide the necessary rating of the penetration.

### **3.05 DRAINS**

- A. Drains shall be located and piped to discharge to the locations designated on the plans. Where required drains are not noted on the plans system drains shall be piped to a floor drain or mop sink where said drains or sinks are capable of accepting full system flow without excessive deflection of discharging water. Drain shall be piped through the wall of the building to atmosphere when a floor drain or mop sink is not available and where piping through the wall of the building to atmosphere is most convenient and has been approved by the Architect/Engineer.

**END OF SECTION**

**SECTION 22 0500**  
**GENERAL PLUMBING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The mechanical contractor shall perform all work and furnish all materials as indicated in the mechanical plans and specifications as necessary for the successful completion of this project.

**1.3 PERMITS AND SERVICES**

- A. The mechanical contractor shall obtain all permits and arrange all inspections, give notices and pay all fees as required by the Authority Having Jurisdiction.
- B. This contractor shall coordinate any necessary site utilities including water, natural gas, and sewer work with local utility, owner, and other contractors to minimize disruption and downtime.  
Clarification to the Bidding - Any natural gas utility costs from Watertown Municipal Utility will be paid directly by the owner and shall not be included as part of this contract. WITH THE EXCEPTION OF THE NATURAL GAS, ANY AND ALL CHARGES ASSESSED BY THE UTILITY OR CITY OF WATERTOWN TO ACCOMMODATE THE REQUIREMENTS OF THIS PROJECT ARE THE SOLE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. VERIFY ALL CHARGES AND COORDINATE ALL EQUIPMENT NECESSARY WITH THE UTILITY BEFORE SUBMITTING BID.

**1.4 DRAWINGS AND MEASUREMENTS**

- A. Verify all dimensions and conditions with Architectural and Structural drawings. The small scale of the drawings prohibits the indication of all offsets, fittings and accessories necessary and shall be furnished by this Contractor and required for complete and proper operation.
- B. "Existing Conditions" shown on drawings are based on existing plans and limited field investigation. The field survey was conducted to verify, as much as possible, the accuracy of the locations shown. The Contractor shall verify the accuracy of the "Existing Conditions" as shown on the drawings. As the demolition work progresses perform modifications and additions as necessary to correct for these hidden conditions and allow for the completion of the new work.
- C. The general arrangement of the mechanical systems shall be as shown on the drawings. Field changes shall have the written acceptance of the Engineer.
- D. Consult the drawings and specifications of all other trades. Layout work and coordinate with other trades, before installing any equipment, to avoid interfering with these trades or conflicting with applicable codes.
- E. The mechanical contractor shall bear full responsibility for coordinating his work with other trades to avoid conflicts in space requirements, clearances, etc. Problems arising due to lack of coordination will be the responsibility of the mechanical contractor to resolve. Extra work and/or equipment as a result of not coordinating work shall be the responsibility of the installing contractor and at no cost to the Owner.

**1.5 INSPECTION OF SITE AND DOCUMENTS**

- A. Before submitting a proposal on the work contemplated, the bidder shall thoroughly familiarize himself with the contract documents, the site, and all existing conditions and limitations that may affect the performance of his work. Any conflict noted shall be brought to the attention of the Engineer before bidding. If there is not sufficient time prior to bidding, the Contractor shall bid the larger quantity or better quality of work.



- B. No extra compensation will be allowed, because of misunderstanding the amount of work involved or the bidder's lack of knowledge, for obvious conflicts which could have been discovered or reasonably anticipated prior to bidding.

#### **1.6 REGULATIONS AND CODES**

- A. All work, materials, and equipment in this contract shall comply with all applicable local, city, state and federal ordinances, regulations, and codes.

#### **1.7 INSTRUCTIONS**

- A. Furnish verbal and engineer approved written instructions to Owner on all systems. Instruction shall include operating procedures, adjustments, and periodic maintenance. Furnish a copy of the written instructions and attach a letter to the Engineer, prior to final inspection, signed by Owner, attesting to date and satisfaction of instructions.

#### **1.8 OPERATING AND MAINTENANCE MANUALS (3 Hard Copies & 1 Electronic Submittal via Submittal Exchange)**

- A. PRIOR TO FINAL INSPECTION, The mechanical contractor shall furnish (3) hard copies (including 1 USB drive containing electronic copy) and (1) electronic submittal via Submittal Exchange of the O&M Manuals to the Engineer, containing all pertinent data to the mechanical systems. Information shall be indexed and labeled per system and shall include catalog cuts, installation manuals, maintenance manuals, manufacturer's names, replacement parts list. Include balancing reports as specified. Include written instructions and warranty info as specified.
- B. The first section shall be indexed/labeled "WRITTEN INSTRUCTIONS & TRAINING" noting written instructions with company service contact info and shall include a list of filters for each unit. Also include document with owners signature attesting to date and satisfaction of training.
- C. The second section shall be indexed/labeled "WARRANTY INFO" and shall include a statement of guarantee on the contractors company letter head and shall include warranty statements of all equipment provided/installed under his contract with specific dates. This will note any longer/special warranties.

#### **1.9 AS-CONSTRUCTED DRAWINGS (Red Lined on Plans & USB Drive containing scanned PDF)**

- A. During construction, each trade shall keep track of the major changes in the rerouting of piping and equipment, and shall note these in red on one set of drawings. This set of drawings shall be submitted with the Operation and Maintenance Manuals along with a USB drive containing a single PDF file with these same red line plans in electronic form. Most printing shops will be able to scan your trade's large plan sheets into electronic form. Contact the engineer's office if there are any questions.

#### **1.10 WORKMANSHIP**

- A. Qualified individuals that are properly licensed to perform the work involved shall perform all mechanical work.

#### **1.11 CUTTING AND PATCHING**

- A. This Contractor shall be responsible for all cutting and patching of holes required for passage of piping, equipment, and ducts. This also applies to the removal or installation of new equipment.
- B. All cutting of existing construction required to install or join new work, except where otherwise indicated on the plans, shall be the responsibility of this Contractor and coordinated with the Construction Manager. Before making any cuts, verify exact locations and sizes with the Construction Manager to confirm that no structural members will be cut. Contractor shall make every effort to minimize extent of cutting existing construction.
- C. The mechanical contractor shall be responsible for patching any openings left in floors, walls, and ceilings that were caused by his/her actions. Patching shall match existing surface in color, texture and quality so that patch is indistinguishable from original surface.

### 1.12 PAINTING

- A. Any equipment which becomes rusted or damaged during construction shall be repaired, cleaned, and repainted by this Contractor. Painting shall always be applied in two coats, one primer and one finish.

### 1.13 EQUIPMENT AND PIPE SUPPORTS

- A. Provide all structural supporting frames, steel stands, concrete bases, and hangers as required for mechanical equipment. All floor equipment shall be set on 4" high concrete bases furnished by this Contractor, unless otherwise noted.
- B. Paint all unprotected metal, except galvanized and copper, with metal protective paint.
- C. **Hangers for piping shall be large enough to encompass insulation. It shall not be acceptable for insulation to envelope hangers/saddles, or for insulation to stop on either side of hangers.**
- D. Provide saddles at all hangers or supports of insulated piping. Saddles for 4" and larger piping shall be fabricated of 14 gauge galvanized iron, and for smaller piping shall be fabricated of 16 gauge galvanized iron. Saddles shall be one-half the circumference of the pipe insulation and 4" shorter than the insulation inserts.
- E. Under no condition shall any pipe or duct structure be used to support another.

### 1.14 ACCESS TO EQUIPMENT

- A. Access shall be provided to all motors, valves, dampers, controls, specialties, etc., for maintenance purposes. All access doors, access panels, removable sections, etc., required for access shall be provided. The location of the access openings relative to the mechanical equipment shall be coordinated to assure proper access to the equipment.
- B. Access openings are required for manual, motorized, fire, and smoke dampers and other devices requiring access and shall be provided in the ductwork, plenums, housings, tanks, etc., under this portion of the contract.

### 1.15 EXCAVATING AND BACKFILLING

- A. When work to be completed by this contractor requires trenching, digging, etc. this contractor shall be responsible for properly protecting open trenches in accordance with required safety procedures. Backfill shall be placed in horizontal layers, not exceeding 9 inches in thickness. Moisten and hand or machine compact to 95% of standard proctor density. Bring fill to elevations indicated. If backfill fails the proctor density test in accordance with ASTM D-2049 and conducted by an independent testing laboratory retained by the owner, Contractor shall recompact and retest until satisfactory density is reached. This contractor shall restore the surface (whether grass, asphalt, concrete, etc.) to its original condition. Grass shall be seeded to match surrounding turf.
- B. When work is in public street, paving repairs shall be equal to and comply with municipal agency requirements. If repairs are done by municipal agency, make necessary arrangement with such agency to make the repairs. Contractor shall include cost for permits, inspection fees, work, etc. in Mechanical Bid.

### 1.16 TESTING AND ADJUSTING

- A. At the completion of work, all parts of the installation under Division 22 shall be cleaned, lubricated, tested, and adjusted for proper operation.
- B. All piping and ductwork shall be tested and cleaned as required, by all local, state and federal codes. Tests shall be performed in the presence of the authority having jurisdiction. Written notification of test, date, and results shall be furnished to the Engineer before concealing or covering the installation.
- C. All controls shall be tested and adjusted for proper operation. Adjustments shall be made when all systems are operating which may affect the control system.
- D. An Independent Testing & Balancing Agent shall test and balance all mechanical systems as specified in Section 23 0593.

### 1.17 GUARANTEE

- A. Warranty: The mechanical contractor shall warrant his work against failure and workmanship for a period of at least one year from the date of substantial completion, for all new work. Any work that is defective within that one-year period shall be replaced by the Contractor without charge. If longer/special warranties are noted elsewhere in the specifications, those warranties shall apply.

### 1.18 EQUIPMENT IDENTIFICATION

- A. Major mechanical equipment, rooftop units, energy recovery ventilators, electric duct heaters, heat pumps, exhaust fans, etc. shall be provided with identification as designated on the plans. Labels shall be black laminate three-layer plastic with engraved 1/2 inch white letters, adhered, screwed, or riveted to the equipment. Manufactured by Brady, Champion America/Seton.
- B. Piping shall be identified as to contents and flow direction with plastic, color coded, snap-on or adhesive labels. Manufactured by Brady, Champion America/Seton.
  - 1. Labeling shall be located:
    - a. Adjacent to each valve.
    - b. At each side of and at each obstruction.
    - c. At each branch.
    - d. At each cap for future.
    - e. At each takeoff.
    - f. At each side of penetration of structure or enclosure.
    - g. At each equipment connection.
    - h. At all access doors.
    - i. A maximum of every 40 feet on straight runs of piping including rises and drops.
    - j. Minimum one label per room/space.
- C. Valve tags shall be brass with stamped letters, tag size 1-1/2" minimum in diameter.
  - 1. Provide typed valve lists in each O&M binder. Valve lists shall include the valve number, location, and purpose of each valve, and any other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.
- D. Color coded indicators shall be installed on the ceiling grid or access door to hard lid areas to indicate all valves and other ceiling mounted equipment requiring service (example – VAV's). Each trade shall be responsible for equipment provided under their respectable trade.
  - 1. Each ceiling label shall be color coded laminated engraved plastic, 1/16" thick, 2.5" wide by 0.75" tall, with white lettering centered on each label. Label to be adhered to the acoustic ceiling tile grid. Seton Style AV0175 or similar.

### 1.19 MECHANICAL SUBMITTAL

- A. All equipment shall be as listed on the equipment schedules or approved equal.
- B. Prior Approval: Manufacturers whose product is not specified or specifically listed on the plans or in the specifications are allowed to submit information on a product that they would like to be considered as an equal to those specified or listed. By submitting this information for consideration, the product representative is indicating that the product being presented for consideration equals or exceeds the specified product in quality, performance and operating parameters. Proof of equality rests with the party making the request. The procedure for this submittal is listed below.
- C. Submit literature on product that is to be considered for prior approval. This literature shall include catalog cuts with all pertinent technical specifications, dimensions and pictures of the product.
- D. Final approval of all equipment shall be contingent on shop drawing acceptance, compliance with the specifications and performance criteria as required. General approval to bid a product does not relieve the supplier or contractor of meeting specific specification requirements.
- E. The Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements

different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.

- F. Literature shall be submitted so that the engineer receives it no later than 7 days prior to bid date.
- G. All approvals will be in the form of an addendum issued to all plan holders.
- H. List of Acceptable Substitutions:
  - 1. All Drains (Floor & Roof): Wade, Zurn, Smith, Josam, Ancon, Watts.
  - 2. Valves: Crane, Hammond, Watts, Rockwell, Milwaukee Valve Co., Mueller.
  - 3. Plumbing Fixtures: American Standard, Kohler, Crane, Elkay, Just, Zurn, Fiat Products, Gerber, Bradley, Stingray
  - 4. Fixture Brass: American Standard, Kohler, Zurn, Sloan, T & S Brass, Chicago, Bradley, Swan, Woodford Mfg.
  - 5. Flush Valves: Zurn AquaVantage, Sloan, American Standard
  - 6. Lav Premolded Insulation Kit: Plumberex, Truebro, Proflo
  - 7. Toilet Seats: Kohler, Church, Beneke, Bemis, Olsonite, Zurn, Proflo
  - 8. Electric Water Coolers: Elkay
  - 9. Electric Domestic Hot Water Heater: Rheem, AO Smith, State Industries, Bradford White
  - 10. Domestic Expansion Tank: Bell & Gossett, Taco, Wessels, Watts, Armstrong, Thrush, Grundfos, Amtrol, American Wheatley, Elbi
  - 11. Digital Water Tempering System: PVI, Powers, Watts
  - 12. Thermostatic Mixing Valves Under Lavs: Lawler, Powers, Watts

#### **1.20 SHOP DRAWINGS**

- A. Before ordering any item, Contractor shall review, stamp with his approval and submit shop drawings of equipment as to be furnished under this contract.
  - 1. Electronic submittals are REQUIRED. Electronic submittals can be one combined .pdf. for each of the following mechanical trades: Fire Sprinkler Drawings, Fire Sprinkler Calcs, Fire Sprinkler Materials, Temperature Controls, HVAC, Plumbing, and Hydronics.
- B. Where the contractor is submitting shop drawings that differ from the plans and specifications, the contractor must notify the engineer in writing each variance from the plans and specifications and the Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.
- C. Product Data shall include, but are not limited to, the following: Manufacturer's product specifications, Manufacturer's installation instructions, standard color charts, catalog cuts, roughing-in diagrams and templates, and standard wiring diagrams.

#### **1.21 TEMPORARY HEAT**

- A. Temporary heating of the building during construction will be provided as specified in the General Conditions and Supplemental General Conditions. Under no circumstance shall the proposed HVAC equipment be brought into service as temporary heating prior to project completion without written permission from the mechanical engineer & owner.

#### **1.22 EXECUTION**

- A. Remove equipment as indicated. Demolition work shall be coordinated with the Owner. Should questions arise regarding the removal of equipment, confer with the owner before such equipment is demolished.
- B. Materials removed by demolition shall remain the property of the Owner unless specifically noted. Material the Owner does not wish to retain shall be removed and properly disposed of by the Contractor.
- C. The existing building will be in use during this construction. Schedule and carry out the work in such a manner as to cause the Owner a minimum of inconvenience due to service interruptions. Temporary services shall be installed if one area or phase of construction

disrupts service to another area of the building or if equipment has to be relocated to allow construction to progress. Service interruptions shall be confined to the smallest area possible at any one time and interruptions shall be scheduled with the Owners site representative. After service has been restored following an interruption, inspect areas affected by the interruption and be responsible for returning automatically controlled equipment to the same operating condition that existed prior to the interruption.

- D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- F. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- G. Final locations of equipment may differ slightly from those shown on these plans. Coordinate exact location of equipment with equipment supplier, structural members, furniture layout and other trades before rough in and adjust accordingly. Pricing shall allow for a minimum of 10 ft. of difference in the actual location of items as compared to the location shown on the drawings.
- H. All penetrations for piping, ductwork, etc. which penetrate floors, fire and/or smoke walls, roofs, full height partitions and similar structures shall be sealed by the mechanical contractor with a UL system specifically approved for the application. This system must maintain the required fire rating.
- I. All mechanical systems shall be tested and cleaned as required by Authority Having Jurisdiction.
- J. The mechanical contractor shall have the full responsibility of ensuring that his/her work is performed in a safe manner and shall bear all liability associated with his/her job site safety.
- K. Upon completion of the work, the Contractor shall notify the A/E and make arrangements for a final inspection. Contractor shall provide A/E with copy of all required balance reports prior to the final inspection.
- L. After the final inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
- M. The Contractor shall comply completely with all listed requirements within (40) days of receipt of list. Should the Contractor fail to perform within this time limit, the A/E and/or Owner reserves the right to have the work completed by others and the cost deducted from the contract price.

**END OF SECTION 22 0500**

**SECTION 22 0510**  
**BASIC PLUMBING MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This section includes the following basic mechanical materials and methods to complement other Division 22 Sections.
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. Mechanical Demolition.
  - 8. Concrete bases.
  - 9. Installation requirements common to equipment specification sections.

**1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, 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.

**1.4 QUALITY ASSURANCE**

- A. All piping shall be specified in this section. Material and installation shall also be subject to state, local codes and ordinances of the area encompassing this project.
- B. Welder's Qualifications: All welder shall be qualified in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- C. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- D. Uninsulated plastic waste, vent and roof drain piping is not allowed above any ceiling in a return air plenum.
- E. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## **PART 2 - PRODUCTS**

### **2.1 PIPE, TUBE, AND FITTINGS**

- A. Provide piping and factory fabricated fittings as indicated for each service and pipe size. Fitting sizes and types shall match piping or equipment connections. Where not indicated, comply with governing regulations or manufacturer's recommendations.

### **2.2 SANITARY WASTE, VENTING, AND STORM DRAIN PIPING**

- A. Below Grade: Extra heavy weight, coated cast iron soil pipe, hub-&-spigot, ASTM A 74, with TY-seal double seal, premolded one piece Neoprene compression type gasket, ASTM C 564, or lead/oakum joint materials, FSQQ-C-40.
  - 1. Service weight "No-Hub" cast iron soil pipe, FS WW-P-401, with Neoprene gasket, ASTM C564, and stainless steel drawband.
  - 2. Where permitted by plumbing and building codes, schedule 40 Polyvinyl Chloride sewer pipe (PVC), ASTM D 2729, with sewer fittings ASTM D 2729, and solvent cement, ASTM D 2564.
- B. Above Grade: Service weight cast iron soil pipe, Hub-&-Spigot, ASTM A 74, with premolded one piece Neoprene compression type gasket, ASTM C 564, or lead/oakum joint materials, FS QQ-C-40.
  - 1. Service weight "No-Hub" cast iron soil pipe, CISPI standard 301, or FS WW-P-401, with Neoprene gasket, ASTM C564, and stainless steel drawband, conforming to CISPI standard 310.
  - 2. Where permitted by plumbing and building codes, schedule 40 Polyvinyl Chloride (PVC), type DWV, ASTM D 2665; with schedule 40 DWV fittings, ASTM D 2665 and patterns conforming to ASTM D 3311. Solvent cement, ASTM D 3138.
- C. Provide a copy of the plot plan showing exact locations of all underground services direct to the engineer with accurate dimensions from the building such that all the underground service can be located.
- D. Before building footings are formed, this contractor shall start excavating for sewer services and shall confirm that depth of existing sewer is such that the building sewer services will drain into it by gravity. If existing sewer is not deep enough, the contractor shall notify the engineer at once.

### **2.3 COOLING CONDENSATE DRAIN PIPING**

- A. Above Grade: Drain piping shall be type "M" copper, ASTM B 88, with cast-copper solder-joint drainage fittings, ANSI B 16.23, or wrought-copper solder joint, ANSI B 16.29, non-corrosive past flux and 50/50 tin-lead solder ASTM B 32.
  - 1. Where permitted, schedule 40 PVC or ABS, solvent weld fittings.

### **2.4 DOMESTIC WATER (COLD, HOT, & RECIRCULATING HOT WATER) IN BUILDING ABOVE GROUND**

- A. Piping shall by Type "L" hard drawn copper water tube. Fittings wrought copper, solder joints. Joints 95-5 or lead free solder.
- B. Uponor PEX-A potable water piping system with Uponor expandable F1960 fittings (no crimp fittings to be accepted) provided the contractor is trained and following all manufacturer's recommendations thus fulfilling all available Uponor warranty coverage.

### **2.5 NATURAL GAS ABOVE GROUND**

- A. Steel Pipe: ASTM A 53; Type E, electric resistance welded or Type S, seamless; Grade B; Schedule 40; black.
- B. Viega MegaPress fittings may be used above grade provided contractor is trained and following all the manufacturer's recommendations and requirements to fulfill all the available warranty coverage.
- C. Install gas shut-off valves & pressure reducing valves to isolate all equipment.

- D. Install 6" traps (drip legs) prior to gas shut-off valves for all equipment controls. See Natural Gas Connection Detail on plans.
- E. All gas piping to comply with AGA and NFPA National Fuel gas Code recommendations and comply with all requirements of the utility supplying the gas.
- F. Comply with all Watertown Municipal Utilities requirements including all piping 2 PSI and greater to be welded.
- G. All piping routed on roofs shall have premanufactured roof blocks with Unistrut support, wood blocking and pipe straps will not be acceptable.
- H. All gas piping in concealed locations shall be welded, CSST, or Viega MegaPress

## **2.6 DIELECTRIC FITTINGS**

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

## **2.7 MECHANICAL SLEEVE SEALS**

- A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

## **2.8 SLEEVES**

- A. The following materials are for wall, floor, slab, and roof penetrations:
  - 1. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
  - 2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
  - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
  - 4. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## **2.9 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.

## **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 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

## **PART 3 - EXECUTION**

### **3.1 MECHANICAL DEMOLITION**

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  - 4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  - 5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### **3.2 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Do not run piping through electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces, if approved by local authority.

- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping to allow maximum possible headroom unless specific mounting heights or slopes are indicated.
- I. Install piping at indicated slopes, or level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install piping to allow application of insulation.
- M. Select system components with pressure rating equal to or greater than system operating pressure.
- N. Install escutcheons for penetrations of walls, ceilings, and floors.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials conforming to the 25/50 flame spread and smoke developed rating.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install 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.

**END OF SECTION 22 0510**

**SECTION 22 0700**  
**PLUMBING SYSTEMS INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The work in this section of the specification and the accompanying drawings consists of performing all labor, equipment, accessories, and materials and in performing all operations necessary for the installation of all insulation for the plumbing, circulating hot water heating piping systems, and sealing of sleeves.
- B. Work to be insulated includes the following:
  - 1. All domestic cold water piping, valves, and fittings.
  - 2. All domestic hot & recirculating hot water piping, valves, and fittings.
  - 3. All roof drain bodies, vertical and horizontal storm drainage and rainleader piping completely down to connection at underground piping or downspout outlet.
  - 4. All condensate drain piping from fan coils, drain pans, louvers, etc.
  - 5. All sleeves.
- C. All insulation work shall be installed in a workmanlike manner by skilled workmen engaged in this type of work.
- D. Fire-Test-Response Characteristics: Provide products with flame-spread and smoke-developed indices of 25 and 50, respectively, according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction.

**1.3 SUBMITTALS**

- A. Shop drawings/product data as specified in Section 22 0500 shall include the following:
  - 1. Product Data: Identify thermal conductivity, thickness, and jackets (both factory installed and field applied, if any), for each type of product indicated.

**1.4 COORDINATION**

- A. Coordinate clearance requirements with duct Installer for insulation application.
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate size and location of supports, hangers, and insulation shields.
  - 1. All hangers and insulation shields for piping shall be large enough to encompass insulation without penetrating vapor barrier.
  - 2. It shall not be acceptable for insulation to envelope hangers/saddles.
  - 3. It shall not be acceptable for insulation to terminate on either side of hangers not properly sized to encompass insulation.

**PART 2 - PRODUCTS**

**2.1 NEW DOMESTIC COLD, HOT, & RECIRCULATING WATER PIPING INSULATION**

- A. All piping in concealed and exposed areas shall be insulated with fiberglass pipe insulation with all service jacket. Jacket shall be factory-applied, and, where specified, with white foil scrim-kraft vapor barrier. Insulation shall be Johns-Manville Micro-Lok 850 APT, or accepted equal.
- B. For pipe sizes 1" and less – insulation thickness shall be ½". For pipe sizes of 1-1/4"-2" – insulation thickness shall be 1". For pipe sizes of 2-1/2" and larger – insulation thickness shall be 1-1/2".
- C. Fittings, valves, flanges, etc. shall be insulated with fiberglass blanket, Johns-Manville Microlite or pre-cut mitered sections for elbows, J-M Micro-Lok (1lb/cu. ft. density).

- D. Encase pipe fitting insulation with one piece pre-molded PVC fitting covers having flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
- E. Provide sheet metal insulation shields at all hanger locations.

## **2.2 NEW STORM PIPING AND ROOF DRAIN BODIES**

- A. All piping in concealed and exposed areas shall be insulated with fiberglass pipe insulation with all service jacket. Jacket shall be factory-applied, and, where specified, with white foil scrim-kraft vapor barrier. Insulation shall be Johns-Manville Micro-Lok 850 HP, or accepted equal.
- B. For all pipe sizes and drain bodies – insulation thickness shall be 1" and be fully vapor sealed.
- C. Fittings, valves, flanges, etc. shall be insulated with fiberglass blanket, Johns-Manville Microlite or pre-cut mitered sections for elbows, J-M Micro-Lok (1lb/cu. ft. density).
- D. Encase pipe fitting insulation with one piece pre-molded Zeston 2000 PVC fitting covers having flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
- E. All storm piping routed inside Wash Bay 969 shall have PVC .020" jacket with 1" extruded polystyrene Styrofoam insulation thru interior wall penetration to existing shop. Fiberglass insulation shall not be acceptable on piping routed through Wash Bay. Seal all seams/connections to supports weather tight.
- F. Provide sheet metal insulation shields at all hanger locations.

## **2.3 COOLING CONDENSATE DRAIN PIPING**

- A. All piping in concealed and exposed areas shall be insulated with flexible elastomeric thermal insulation consisting of closed-cell, sponge- or expanded rubber materials. Comply with ASTM C 534, Type I for tubular materials, Type II for sheet materials. Maximum thermal conductivity of 0.28 at 75 degrees.
  - 1. Provide adhesives as recommended by insulation material manufacturer.
  - 2. Provide ultraviolet-protective coating as recommended by insulation material manufacturer.
- B. Insulation thickness shall be ½" and shall include a vapor retarder.
- C. Fittings, valves, flanges, etc. shall be insulated with prefabricated thermal insulating fitting covers complying with ASTM C 450 for dimensions used in performing insulation to cover valves, elbows, tee, and flanges.
- D. Install per manufacturer's recommendations.

## **PART 3 - EXECUTION**

### **3.1 GENERAL APPLICATION**

- A. All insulation shall be applied on clean, dry surfaces. All joints shall be snugly butted against the adjoining piece and all joints, seams, voids, flat spots, etc., shall be filled with insulation cement. Do not use cut pieces or scraps abutting each other.
- B. Where double layers are installed, the first layer shall be fastened with binding wire. All joints shall be staggered between the two layers.
- C. Insulation on all cold surfaces must be applied in a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- D. All surface finishes shall be extended to protect all surfaces, ends, and raw edges of insulation.
- E. All insulation materials shall be installed in strict accordance with manufacturer's instructions, using recommended adhesives, mastics and coatings applied at specific coverage per gallon and temperature conditions.
- F. Extend insulation without interruption through walls, floors and similar penetrations, except where otherwise indicated.

- G. Maintain integrity of vapor-barrier jackets on insulation, and protect to prevent puncture or other damage.
- H. Do not apply insulation to equipment, breechings, or stacks while hot.
- I. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- J. Provide removable insulation sections to cover parts of equipment, which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- K. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.
- L. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

### **3.2 MINERAL-FIBER PIPE INSULATION APPLICATION**

- A. Fittings, valves, and flange insulation shall be wrapped firmly under compression (minimum 2:1) to a thickness equal to the adjoining insulation, secured with No. 20 gauge galvanized annealed steel wire, and finished with a smoothing coat of mastic, Johns-Manville No. 375 Insulating and Finishing Cement or equal.
- B. Cold Fittings, Valves, Flanges, etc., shall be additionally sealed with a layer of resin coated glass mesh, such as Johns-Manville Duramesh 207 glass cloth, embedded between two 1/16" thick coats of vapor barrier coating, Benjamin Foster 30-35 or equal. Lap the sealed glass cloth at least 2" on itself and the adjoining insulation.
- C. Premolded Insulation Valve and Fitting Covers shall be installed by tack fastening, banding, or taping as required by manufacturer.
- D. Expansion Joints: For expansion joints, a tube of pipe insulation shall be fabricated that will allow the expansion joint to move within the tube. The insulating tube shall be fastened at one end of the pipe or equipment and the other end shall be free to slide over the adjacent insulated piping. Provide an aluminum jacket over the insulated pipe to provide a smooth surface on which the insulated tube may slide.
- E. Insulation Under Hangers: Pipe hangers shall encompass the insulation and shall have sheet metal saddles furnished by the Mechanical Contractor.
- F. Inserts shall be installed at all hanger locations. Inserts between the pipe and pipe hangers shall consist of 13lb/cubic foot hydrous calcium silicate pipe insulation, or wood blocking, of thickness equal to the adjoining insulation and shall be provided with vapor barriers where required. Insulation inserts shall not be less than the following lengths:
  - 1. 1/2" to 1-1/2" pipe size 10" long
  - 2. 3" to 6" pipe size 12" long
  - 3. 8" and larger pipe size 16" long
- G. On all piping the full thickness of insulation and jacket shall run continuously under the sheet metal pipe saddle and through the pipe hanger (pipe hanger shall be large enough to permit full insulation thickness.)

### **3.3 FLEXIBLE ELASTOMERIC PIPE INSULATION APPLICATION:**

- A. Apply insulation to straight pipes and tubes as follows:
  - 1. Follow manufacturer's written instructions for applying insulation.
  - 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- B. Apply insulation to fittings and elbows as follows:
  - 1. Apply mitered sections of pipe insulation.
- C. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

- D. Insulation Under Hangers: Pipe hangers shall encompass the insulation and shall have sheet metal saddles furnished by the Mechanical Contractor.
- E. Inserts shall be installed at all hanger locations. Inserts between the pipe and pipe hangers shall consist of 13lb/cubic foot hydrous calcium silicate pipe insulation, or wood blocking, of thickness equal to the adjoining insulation and shall be provided with vapor barriers where required. Insulation inserts shall not be less than the following lengths:
  - 1. 1/2" to 1-1/2" pipe size 10" long
  - 2. 3" to 6" pipe size 12" long
  - 3. 8" and larger pipe size 16" long
- F. On all piping the full thickness of insulation and jacket shall run continuously under the sheet metal pipe saddle and through the pipe hanger (pipe hanger shall be large enough to permit full insulation thickness.)

### **3.4 SEALING OF SLEEVES**

- A. All sleeves for pipes, ductwork, etc., furnished under Division 22 of specifications, penetrating floors, fire and/or smoke walls and full height partitions, including chase walls, shall be sealed in accordance with the following:
  - 1. All insulated services shall have the specified insulation terminated on either side of sleeve. Services which require a vapor barrier jacket shall have segment through sleeve insulated with calcium silicate having a minimum thickness same as specified for service. Vapor barrier jacket shall be uninterrupted. Entire void space between inside of sleeve and outside of duct, pipe, and/or calcium silicate insulation shall be packed with fiber insulation, conforming to HHI-521E Type 3 or HHI-558B Form A and having an ASTM fire class E-84 with fiber melt point in excess of 2000 degrees F., to a point 1/8 inch from ends of pipe sleeve. After void is packed with fiber insulation, services which are specified to be insulated shall have a section of insulation installed on each side of sleeve, insulation to be fitted tight to sleeve insulation. Balance of space in sleeve to be filled with nonhardening silicone conforming to TTS-00230 and of type which will allow 50 percent movement in one direction.
  - 2. Contractor is herein given the option to provide Pipe Shield, Inc., fire rated wall and floor sleeves for insulated and noninsulated piping in lieu of sealing sleeves as outlined above. Shields shall be installed in strict accordance with manufacturer's recommendations.

**END OF SECTION 22 0700**

**SECTION 22 4000  
PLUMBING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The work in this specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install complete systems listed below, including minor items obviously necessary for complete and operating systems.
  - 1. Plumbing Fixtures
  - 2. Soil, Waste, Sanitary Drainage, and Vent Piping
  - 3. Storm Drainage System
  - 4. Gravity Condensate Drain Piping
  - 5. Natural Gas Piping Systems
- B. The plumbing work shall be installed in strict accordance with all applicable local, state, national plumbing regulations, and authority having jurisdiction.

**1.3 SUBMITTALS**

- A. Shop drawings as specified in Section 22 0500 shall include the following:
  - 1. Sanitary Sewer Service Stub Out Piping
  - 2. Storm Sewer Service Stub Out Piping
  - 3. Domestic Water System Piping, Valves, and Fittings
  - 4. Sanitary Waste & Vent System Piping and Fittings
  - 5. Storm Sewer System Piping and Fittings
  - 6. Gravity Condensate Drain Piping
  - 7. Natural Gas System Piping, Valves, Fittings, Roof Supports
  - 8. Natural Gas Pressure Reducing Valves
  - 9. Plumbing Fixtures
  - 10. Floor Drains
  - 11. Interior Cleanouts
  - 12. Primary & Overflow Roof Drains
  - 13. Shock Absorbers & Mfg's Recommended Locations to be Installed
  - 14. Digital Thermostatic Mixing Valve
  - 15. Electric Domestic Hot Water Heater
  - 16. Domestic Water System Expansion Tank
  - 17. Drain Valves with Chained Caps

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Before proceeding with this part of the work, the Contractor shall carefully survey the existing conditions, and, if necessary, modify the service installation, in order to avoid unforeseen obstructions such as in the floor ductwork, etc. This Contractor shall include all costs for this work, including saw cutting & patching, permits, etc., in his bid.

**2.2 SANITARY SEWER SERVICE**

- A. Provide new sewer services as indicated on the plans. Provide minimum 5'-6" cover over sewer line outside of building. Provide main clean out where sewer leaves building as indicated on the plans. Before building footings are formed, this contractor shall start excavating for sewer services and shall confirm that depth of existing sewer is such that building sewer services will drain into it by gravity. If existing sewer is not deep enough, the contractor shall notify the Engineer at once.



- B. Before proceeding with this part of the work, the Contractor shall carefully survey the existing conditions, and, if necessary, modify the service installation, in order to avoid unforeseen obstructions, such as telephone cables, cisterns, electrical conduits, large tree roots, existing water and sewer lines, flag pole bases, etc. This Contractor shall include all costs for this work, including street and sidewalk repair, permits, etc., in his bid.

### **2.3 STORM SEWER SERVICE**

- A. Provide new storm sewer services as indicated on the plans. Provide minimum 5'-6" cover over sewer line outside of building. Provide main clean out where sewer leaves building as indicated on the plans. Before building footings are formed, this contractor shall start excavating for sewer services and shall confirm that depth of existing sewer is such that building sewer services will drain into it by gravity. If existing sewer is not deep enough, the contractor shall notify the Engineer at once.
- B. Before proceeding with this part of the work, the Contractor shall carefully survey the existing conditions, and, if necessary, modify the service installation, in order to avoid unforeseen obstructions, such as telephone cables, cisterns, electrical conduits, large tree roots, existing water and sewer lines, flag pole bases, etc. This Contractor shall include all costs for this work, including street and sidewalk repair, permits, etc., in his bid.

### **2.4 NATURAL GAS SYSTEM PRESSURE REDUCING VALVES**

- A. See section 22 0510 Basic Plumbing Materials and Methods for Piping Specifications.
- B. Furnish and install gas pressure reducing valves where shown on plans per manufacturer's recommendations. Type and size shall be as shown on plans. Confirm equipment pressure requirements prior to ordering.
- C. Natural gas pressure reducing valves shall be automatic vent limiting devices or install venting per manufacturer's recommendations.
- D. Provide isolation valves as shown on plans.

### **2.5 PLUMBING FIXTURES**

- A. Furnish and install plumbing fixtures where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. Where indicated on the drawings to be a future fixture, this contractor shall provide all waste, vent, and water supplies as indicated on the drawings and according to local code.
- C. Exposed flush, waste, and supply pipes at the fixtures shall be chromium plated brass pipe, iron pipe size. Fittings for brass pipe shall be cast brass, chromium plated.
- D. Install chromium plated wall or floor plates (escutcheons) with set-screw where piping passes through walls or floors.
- E. All handicap laboratories supply pipe and drain pipe will be fitted with removable safety covers that comply with handicap code requirements.
- F. All fixtures fitted to the walls or floors shall be ground and true and be sealed with a non-hardening white silicone caulk bead.
- G. All plumbing fixtures shall be supported per manufacturer's recommendations.

### **2.6 FLOOR DRAINS**

- A. Furnish and install floor drains where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Connect outlet of drain to "P" trap. Venting installation requirements of floor drains whether or not shown on plans shall be according to code and approved by the code official.
- B. Furnish and install any floor drains required by the authority having jurisdiction to meet the Uniform Plumbing Code 2009 704.3.

## **2.7 CLEANOUTS (INTERIOR ONLY)**

- A. Furnish and install clean outs where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Install proper traffic rating and floor pattern shape for intended use.
- B. Cleanouts shall be provided at the base of all vertical stacks with the cleanout plug located approximately 12" above the floor and extended to wall access cover. Cleanouts in floors on grade shall be located as shown on plans and at changes in direction of pipe run and shall consist of Y fittings and eighth bends. Cleanouts must be provided in accordance with the local code and as shown on the drawings.
- C. Floor cleanouts – frame and cover threaded for 2" vertical adjustment, threads protected with shield to be removed when concrete is set. Covers-nickel bronze round frame and cover, deep flange tractor type. Extra heavy type in heavy traffic areas, and with carpet cleanout marker for carpeted floors.
- D. Wall Cleanouts – access covers shall be stainless steel.
- E. Provide exterior ground cleanouts up to grade from sewer mains where service exits the building, as shown on drawing, and using service weight cast iron soil pipe up to grade (regardless of the type of material for the line). If not in concrete, pour an 18"x18"x6" concrete pad around cleanout and install flush with surrounding surface. Cleanout to be Zurn Z-1474-VP Heavy Duty Cleanout with dura-coated cast iron top and vandal proof screws or equal by Zurn, Blake, Josam, or Smith.

## **2.8 PRIMARY & OVER FLOW ROOF DRAINS**

- A. Furnish and install roof drains where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings
- B. Roof drains shall be cast iron body, cast iron dome, sump receiver, underdeck clamp, and no-hub outlet. 2" dam where applies at overflow roof drains.
- C. Installation shall be as per manufacturer's recommendations.

## **2.9 ROOF JACKET**

- A. Roof extension from soil, waste, and vent pipes shall be extended at least 18 inches above the roof, and must be encased in frostproof jackets, each having an air space at least 1" between the outside surface of the pipe and a cap over the top of the pipe so that it will be unnecessary otherwise to plug the inside of the vent pipes at the top when the test is made. These plugs must be of a type readily seen until removed. Remove them at once after the piping system has been tested and approved.

## **2.10 SHOCK ABSORBERS**

- A. Piping shall be installed with proper safeguards to prevent water hammer. This will be done by installing a sufficient number of shock absorbers. Shock absorbers shall be Watts or equal.
- B. Contractor to indicate installed locations on as-built drawings.

## **2.11 DIGITAL WATER TEMPERING SYSTEM**

- A. Temperature control system shall be controlled digitally via integrated circuit board technology designed to deliver blended water economically at accurate temperature selected by user as safe and appropriate for sanitary use in facility's recirculated hot water system. The mixing valve shall be a PVI DigiTemp with model as noted on plans.
- B. Construction shall be lead free design and in compliance with lead free laws. Digital water temperature control and monitoring system shall feature full-color 3.5" touchscreen interface capable of displaying 196 combinations of critical system data in standard or metric measurements. Unit shall be user-configurable on location and shall not require factory pre-programming prior to shipment. Temperature adjustment shall be made locally by user at the control module and shall not require a laptop computer or special software to initiate. BAS to monitor and override.

- C. System shall control water temperature to +/- 2°F in accordance with ASSE 1017 and during periods of low and zero demand, and maintain a consistent system "idling" temperature to mitigate "temperature creep" without the use of a manual throttling device/balancing valve. The high-speed actuator shall be located external to mixing chamber where water from valve cannot affect performance as a result of faulty o-rings or seals.
- D. System shall feature Feed Forward or Predictive Control which anticipates changes in system demand and adjusts valve pre-emptively to maintain mixed set point. Control module shall be password protected to help prevent unauthorized adjustment or tampering with settings.
- E. System shall digitally monitor and display the following without the use of an external module, laptop and special software that must be downloaded:
  - 1. Mixed outlet temperature and mixed outlet set point in oF/oC
- F. Control module shall integrate with building automation systems through BACnet and Modbus protocols without the use of a separate module, and feature local and remote temperature alarms. System will also feature a password protected, user-selected high-temperature sanitization mode for operation as part of a user's safe and properly designed thermal bacteria eradication protocol.
- G. In the event of a power failure or loss of cold water, system will close the hot water supply via an internally charged capacitor and is not reliant on batteries which must be replaced. Actuator shall also feature a manual override which can be used to set mixed outlet temperature in the event of a power loss.
- H. System shall be listed/approved to ASSE 1017, cUPC, NSF and CSA 24/UL873. System shall come with a standard 5-year limited warranty.
- A. Provide & install unions as shown on piping detail to facilitate simple unit removal for maintenance.

## **2.12 ELECTRIC DOMESTIC HOT WATER HEATER**

- A. Furnish and install water heaters where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Equip tank with ASME rated temperature pressure relief valve. Unit shall be UL listed and exceed the minimum efficiency requirements of ASHRAE/IES 90.1b-1992.
- B. Provide & install accessories as scheduled on the plans.

## **2.13 WATER SYSTEM EXPANSION TANK**

- A. Furnish and install a pre-pressured expansion tank as scheduled on the drawings or prior approved equal.

## **2.14 MISCELLANEOUS CONNECTIONS**

- A. Make all domestic water, waste, vent, gas, air, etc., connections to all equipment in this building whether or not such equipment is furnished under this section or under other sections of the specification. This includes furnishing piping, traps (if required) and shut-off valves on branches to and from each piece of equipment from mains or branch mains.
- B. Make all plumbing connections to existing piping and to all equipment shown on the plans as requiring same. If specific piping details are not shown, the equipment shall be roughed in for and connected in accordance with the manufacturer's recommendations. It will be this contractor's responsibility to obtain shop drawings from whomever furnishes the equipment.

## **2.15 TESTING/CLEANING**

- A. The mechanical contractor is responsible for the testing & cleaning of each respective system in accordance with applicable state and local codes. Tests shall be repeated until each system is proven acceptable.

**END OF SECTION 22 4000**

**SECTION 23 0500**  
**GENERAL HVAC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The mechanical contractor shall perform all work and furnish all materials as indicated in the mechanical plans and specifications as necessary for the successful completion of this project.

**1.3 PERMITS AND SERVICES**

- A. The mechanical contractor shall obtain all permits and arrange all inspections, give notices and pay all fees as required by the Authority Having Jurisdiction.
- B. This contractor shall coordinate any necessary site utilities including water, natural gas, and sewer work with local utility, owner, and other contractors to minimize disruption and downtime.  
Clarification to the Bidding - Any natural gas utility costs from Watertown Municipal Utility will be paid directly by the owner and shall not be included as part of this contract. WITH THE EXCEPTION OF THE NATURAL GAS, ANY AND ALL CHARGES ASSESSED BY THE UTILITY OR CITY OF WATERTOWN TO ACCOMMODATE THE REQUIREMENTS OF THIS PROJECT ARE THE SOLE RESPONSIBILITY OF THE MECHANICAL CONTRACTOR. VERIFY ALL CHARGES AND COORDINATE ALL EQUIPMENT NECESSARY WITH THE UTILITY BEFORE SUBMITTING BID.

**1.4 DRAWINGS AND MEASUREMENTS**

- A. Verify all dimensions and conditions with Architectural and Structural drawings. The small scale of the drawings prohibits the indication of all offsets, fittings and accessories necessary and shall be furnished by this Contractor and required for complete and proper operation.
- B. "Existing Conditions" shown on drawings are based on existing plans and limited field investigation. The field survey was conducted to verify, as much as possible, the accuracy of the locations shown. The Contractor shall verify the accuracy of the "Existing Conditions" as shown on the drawings. As the demolition work progresses perform modifications and additions as necessary to correct for these hidden conditions and allow for the completion of the new work.
- C. The general arrangement of the mechanical systems shall be as shown on the drawings. Field changes shall have the written acceptance of the Engineer.
- D. Consult the drawings and specifications of all other trades. Layout work and coordinate with other trades, before installing any equipment, to avoid interfering with these trades or conflicting with applicable codes.
- E. The mechanical contractor shall bear full responsibility for coordinating his work with other trades to avoid conflicts in space requirements, clearances, etc. Problems arising due to lack of coordination will be the responsibility of the mechanical contractor to resolve. Extra work and/or equipment as a result of not coordinating work shall be the responsibility of the installing contractor and at no cost to the Owner.

**1.5 INSPECTION OF SITE AND DOCUMENTS**

- A. Before submitting a proposal on the work contemplated, the bidder shall thoroughly familiarize himself with the contract documents, the site, and all existing conditions and limitations that may affect the performance of his work. Any conflict noted shall be brought to the attention of the Engineer before bidding. If there is not sufficient time prior to bidding, the Contractor shall bid the larger quantity or better quality of work.

- B. No extra compensation will be allowed, because of misunderstanding the amount of work involved or the bidder's lack of knowledge, for obvious conflicts which could have been discovered or reasonably anticipated prior to bidding.

#### **1.6 REGULATIONS AND CODES**

- A. All work, materials, and equipment in this contract shall comply with all applicable local, city, state and federal ordinances, regulations, and codes.

#### **1.7 INSTRUCTIONS**

- A. Furnish verbal and engineer approved written instructions to Owner on all systems. Instruction shall include operating procedures, adjustments, and periodic maintenance. Furnish a copy of the written instructions and attach a letter to the Engineer, prior to final inspection, signed by Owner, attesting to date and satisfaction of instructions.

#### **1.8 OPERATING AND MAINTENANCE MANUALS (3 Hard Copies & 1 Electronic Submittal via Submittal Exchange)**

- A. PRIOR TO FINAL INSPECTION, The mechanical contractor shall furnish (3) hard copies (including 1 USB drive containing electronic copy) and (1) electronic submittal via Submittal Exchange of the O&M Manuals to the Engineer, containing all pertinent data to the mechanical systems. Information shall be indexed and labeled per system and shall include catalog cuts, installation manuals, maintenance manuals, manufacturer's names, replacement parts list. Include balancing reports as specified. Include written instructions and warranty info as specified.
- B. The first section shall be indexed/labeled "WRITTEN INSTRUCTIONS & TRAINING" noting written instructions with company service contact info and shall include a list of filters for each unit. Also include document with owners signature attesting to date and satisfaction of training.
- C. The second section shall be indexed/labeled "WARRANTY INFO" and shall include a statement of guarantee on the contractors company letter head and shall include warranty statements of all equipment provided/installed under his contract with specific dates. This will note any longer/special warranties.

#### **1.9 AS-CONSTRUCTED DRAWINGS (Red Lined on Plans & USB Drive containing scanned PDF)**

- A. During construction, each trade shall keep track of the major changes in the rerouting of piping and equipment, and shall note these in red on one set of drawings. This set of drawings shall be submitted with the Operation and Maintenance Manuals along with a USB drive containing a single PDF file with these same red line plans in electronic form. Most printing shops will be able to scan your trade's large plan sheets into electronic form. Contact the engineer's office if there are any questions.

#### **1.10 WORKMANSHIP**

- A. Qualified individuals that are properly licensed to perform the work involved shall perform all mechanical work.

#### **1.11 CUTTING AND PATCHING**

- A. This Contractor shall be responsible for all cutting and patching of holes required for passage of piping, equipment, and ducts. This also applies to the removal or installation of new equipment.
- B. All cutting of existing construction required to install or join new work, except where otherwise indicated on the plans, shall be the responsibility of this Contractor and coordinated with the Construction Manager. Before making any cuts, verify exact locations and sizes with the Construction Manager to confirm that no structural members will be cut. Contractor shall make every effort to minimize extent of cutting existing construction.
- C. The mechanical contractor shall be responsible for patching any openings left in floors, walls, and ceilings that were caused by his/her actions. Patching shall match existing surface in color, texture and quality so that patch is indistinguishable from original surface.

### 1.12 PAINTING

- A. Any equipment which becomes rusted or damaged during construction shall be repaired, cleaned, and repainted by this Contractor. Painting shall always be applied in two coats, one primer and one finish.

### 1.13 EQUIPMENT AND PIPE SUPPORTS

- A. Provide all structural supporting frames, steel stands, concrete bases, and hangers as required for mechanical equipment. All floor equipment shall be set on 4" high concrete bases furnished by this Contractor, unless otherwise noted.
- B. Paint all unprotected metal, except galvanized and copper, with metal protective paint.
- C. **Hangers for piping shall be large enough to encompass insulation. It shall not be acceptable for insulation to envelope hangers/saddles, or for insulation to stop on either side of hangers.**
- D. Provide saddles at all hangers or supports of insulated piping. Saddles for 4" and larger piping shall be fabricated of 14 gauge galvanized iron, and for smaller piping shall be fabricated of 16 gauge galvanized iron. Saddles shall be one-half the circumference of the pipe insulation and 4" shorter than the insulation inserts.
- E. Under no condition shall any pipe or duct structure be used to support another.

### 1.14 ACCESS TO EQUIPMENT

- A. Access shall be provided to all motors, valves, dampers, controls, specialties, etc., for maintenance purposes. All access doors, access panels, removable sections, etc., required for access shall be provided. The location of the access openings relative to the mechanical equipment shall be coordinated to assure proper access to the equipment.
- B. Access openings are required for manual, motorized, fire, and smoke dampers and other devices requiring access and shall be provided in the ductwork, plenums, housings, tanks, etc., under this portion of the contract.

### 1.15 EXCAVATING AND BACKFILLING

- A. When work to be completed by this contractor requires trenching, digging, etc. this contractor shall be responsible for properly protecting open trenches in accordance with required safety procedures. Backfill shall be placed in horizontal layers, not exceeding 9 inches in thickness. Moisten and hand or machine compact to 95% of standard proctor density. Bring fill to elevations indicated. If backfill fails the proctor density test in accordance with ASTM D-2049 and conducted by an independent testing laboratory retained by the owner, Contractor shall recompact and retest until satisfactory density is reached. This contractor shall restore the surface (whether grass, asphalt, concrete, etc.) to its original condition. Grass shall be seeded to match surrounding turf.
- B. When work is in public street, paving repairs shall be equal to and comply with municipal agency requirements. If repairs are done by municipal agency, make necessary arrangement with such agency to make the repairs. Contractor shall include cost for permits, inspection fees, work, etc. in Mechanical Bid.

### 1.16 TESTING AND ADJUSTING

- A. At the completion of work, all parts of the installation under Division 23 shall be cleaned, lubricated, tested, and adjusted for proper operation.
- B. All piping and ductwork shall be tested and cleaned as required, by all local, state and federal codes. Tests shall be performed in the presence of the authority having jurisdiction. Written notification of test, date, and results shall be furnished to the Engineer before concealing or covering the installation.
- C. All controls shall be tested and adjusted for proper operation. Adjustments shall be made when all systems are operating which may affect the control system.
- D. An Independent Testing & Balancing Agent shall test and balance all mechanical systems as specified in Section 23 0593.

### 1.17 GUARANTEE

- A. Warranty: The mechanical contractor shall warrant his work against failure and workmanship for a period of at least one year from the date of substantial completion, for all new work. Any work that is defective within that one-year period shall be replaced by the Contractor without charge. If longer/special warranties are noted elsewhere in the specifications, those warranties shall apply.

### 1.18 EQUIPMENT IDENTIFICATION

- A. Major mechanical equipment, rooftop units, energy recovery ventilators, electric duct heaters, heat pumps, exhaust fans, etc. shall be provided with identification as designated on the plans. Labels shall be black laminate three-layer plastic with engraved 1/2 inch white letters, adhered, screwed, or riveted to the equipment. Manufactured by Brady, Champion America/Seton.
- B. Piping shall be identified as to contents and flow direction with plastic, color coded, snap-on or adhesive labels. Manufactured by Brady, Champion America/Seton.
  - 1. Labeling shall be located:
    - a. Adjacent to each valve.
    - b. At each side of and at each obstruction.
    - c. At each branch.
    - d. At each cap for future.
    - e. At each takeoff.
    - f. At each side of penetration of structure or enclosure.
    - g. At each equipment connection.
    - h. At all access doors.
    - i. A maximum of every 40 feet on straight runs of piping including rises and drops.
    - j. Minimum one label per room/space.
- C. Valve tags shall be brass with stamped letters, tag size 1-1/2" minimum in diameter.
  - 1. Provide typed valve lists in each O&M binder. Valve lists shall include the valve number, location, and purpose of each valve, and any other necessary information such as the required opening or closing of another valve when one valve is to be opened or closed.
- D. Color coded indicators shall be installed on the ceiling grid or access door to hard lid areas to indicate all valves and other ceiling mounted equipment requiring service (example – VAV's). Each trade shall be responsible for equipment provided under their respectable trade.
  - 1. Each ceiling label shall be color coded laminated engraved plastic, 1/16" thick, 2.5" wide by 0.75" tall, with white lettering centered on each label. Label to be adhered to the acoustic ceiling tile grid. Seton Style AV0175 or similar.

### 1.19 MECHANICAL SUBMITTAL

- A. All equipment shall be as listed on the equipment schedules or approved equal.
- B. Prior Approval: Manufacturers whose product is not specified or specifically listed on the plans or in the specifications are allowed to submit information on a product that they would like to be considered as an equal to those specified or listed. By submitting this information for consideration, the product representative is indicating that the product being presented for consideration equals or exceeds the specified product in quality, performance and operating parameters. Proof of equality rests with the party making the request. The procedure for this submittal is listed below.
- C. Submit literature on product that is to be considered for prior approval. This literature shall include catalog cuts with all pertinent technical specifications, dimensions and pictures of the product.
- D. Final approval of all equipment shall be contingent on shop drawing acceptance, compliance with the specifications and performance criteria as required. General approval to bid a product does not relieve the supplier or contractor of meeting specific specification requirements.
- E. The Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements

different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.

- F. Literature shall be submitted so that the engineer receives it no later than 7 days prior to bid date.
- G. All approvals will be in the form of an addendum issued to all plan holders.
- H. List of Acceptable Substitutions:
  - 1. Equipment Identification, Pipe Labeling, Valve Tags, Ceiling Grid Labeling: Seton, Brady Corporation, Marking Services Incorporated
  - 2. Packaged Makeup Air Rooftop Unit with Integral Hot Water Coil: Daikin Applied (must provide technical submittal minimum 7 days prior to bid opening for consideration)
  - 3. Duct Mounted Hot Water Coils: Daikin, Super Radiator, Trane, Carrier, York, Precision Coils, Greenheck
  - 4. Cooling Only Fan Coil & Air Cooled Condensing Unit:
  - 5. Fan Powered VAV Terminal Units & Shutoff VAV Terminal Units: Carrier, Price, Krueger, Nailor, Trane, Tuttle & Bailey, Titus, JCI
  - 6. Power Roof Ventilator Exhaust Fans: PennBarry, Greenheck, Loren Cook, ACME, ILG Air Specialties Express/Carnes, Aerovent, Twin City Fan & Blower
  - 7. Ceiling Exhaust Fans: PennBarry, Greenheck, Loren Cook, ACME, ILG Air Specialties Express/Carnes, Aerovent, Panasonic Twin City Fan & Blower
  - 8. Vehicle Exhaust System Fans/Reels: Central Pointe, Inc., no substitutions
  - 9. NO2CO Detector: Brasch, ACME, Intec, Macurco
  - 10. Registers, Grilles, & Diffusers: Metalaire, Price, Tuttle & Bailey, Krueger, Nailor, Hart & Cooley, Anemostat, Nailor, J & J Register, Air Specialties Express/Carnes, Titus
  - 11. Stationary Louver: ACME, Ruskin, Pottorff, Arrow United Industries, Greenheck, Air Balance, Nailor, NCA, Safe-Air Dowco
  - 12. Control Dampers: Ruskin, Safe Air, Air Balance, Nailor, Cesco, Advance Air, Air Control Products, International Air, Greenheck, Pottoff, Lloyd, NCA, United Enertech
  - 13. Smoke Dampers: Ruskin, Safe Air, Air Balance, Nailor, Cesco, Advance Air, Air Control Products, International Air, Greenheck, Pottoff, Lloyd, NCA, United Enertech
  - 14. Double Wall Pressure Rated Boiler Venting System: Metal Fab, Heat Fab, Duravent
  - 15. Ethylene Glycol: Dowtherm SR-1, no substitutions
  - 16. Pressure-compensating Flow Control and Strainer Valves: Pro Hydronics, Griswold, Autoflow, B&G, Nexus, Flow Design, IMI Flow Design
  - 17. Condensing Boiler-Burner Units: Thermal Solutions EVS (must provide technical submittal minimum 7 days prior to bid opening for consideration)
  - 18. Hydronic Pumps: Armstrong, Taco, B&G, Allis-Chalmers, General Signal Pump Group, Thrush, Patterson, Grundfos
  - 19. Hydronic Expansion Tanks: Bell & Gossett, Taco, Wessels, Watts, Armstrong, Thrush, Grundfos, Amtrol, American Wheatley, Elbi
  - 20. Hydronic Air Separators: Bell & Gossett, Taco, Wessels, Watts, Armstrong, Thrush, Grundfos
  - 21. Bypass Filter Feeder: Vector Industries, Neptune, Wessels
  - 22. Radiant Ceiling Panels: Airtex, Sigma, Sterlin, Airtherm, Vulcan, Rittling, TWA, Price
  - 23. Inverted Finned Tube Radiation: Sigma, Sterlin, Airtherm, Vulcan, Rittling, Modine
  - 24. Hot Water Cabinet Unit Heaters: Sigma, Sterlin, Airtherm, Vulcan, Rittling, Modine, Airtherm
  - 25. Infloor Heat Piping: (Must use F1960 Cold Expansion Fittings & PEX-A oxygen barrier tubing) – Uponor, Rehau, Heatlink
  - 26. DDC Temperature Controls (BACnet): Invensys by Johnson Controls Inc., no substitutions.
    - a. VFD's – Johnson Controls, no substitutions.

## 1.20 SHOP DRAWINGS

- A. Before ordering any item, Contractor shall review, stamp with his approval and submit shop drawings of equipment as to be furnished under this contract.



1. Electronic submittals are REQUIRED. Electronic submittals can be one combined .pdf. for each of the following mechanical trades: Fire Sprinkler Drawings, Fire Sprinkler Calcs, Fire Sprinkler Materials, Temperature Controls, HVAC, Plumbing, and Hydronics.
- B. Where the contractor is submitting shop drawings that differ from the plans and specifications, the contractor must notify the engineer in writing each variance from the plans and specifications and the Mechanical Contractor shall pay, provide, install and be responsible for any extra materials required due to his use of alternate accepted equipment which has installation requirements different than the specified equipment. This includes paying other trades for any extra work they are involved in due to this substitution of equipment.
- C. Product Data shall include, but are not limited to, the following: Manufacturer's product specifications, Manufacturer's installation instructions, standard color charts, catalog cuts, roughing-in diagrams and templates, and standard wiring diagrams.

#### **1.21 TEMPORARY HEAT**

- A. Temporary heating of the building during construction will be provided as specified in the General Conditions and Supplemental General Conditions. Under no circumstance shall the proposed HVAC equipment be brought into service as temporary heating prior to project completion without written permission from the mechanical engineer & owner.

#### **1.22 EXECUTION**

- A. Remove equipment as indicated. Demolition work shall be coordinated with the Owner. Should questions arise regarding the removal of equipment, confer with the owner before such equipment is demolished.
- B. Materials removed by demolition shall remain the property of the Owner unless specifically noted. Material the Owner does not wish to retain shall be removed and properly disposed of by the Contractor.
- C. The existing building will be in use during this construction. Schedule and carry out the work in such a manner as to cause the Owner a minimum of inconvenience due to service interruptions. Temporary services shall be installed if one area or phase of construction disrupts service to another area of the building or if equipment has to be relocated to allow construction to progress. Service interruptions shall be confined to the smallest area possible at any one time and interruptions shall be scheduled with the Owners site representative. After service has been restored following an interruption, inspect areas affected by the interruption and be responsible for returning automatically controlled equipment to the same operating condition that existed prior to the interruption.
- D. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- E. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- F. Coordinate mechanical equipment and materials installation with other building components. Verify all dimensions by field measurements. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- G. Final locations of equipment may differ slightly from those shown on these plans. Coordinate exact location of equipment with equipment supplier, structural members, furniture layout and other trades before rough in and adjust accordingly. Pricing shall allow for a minimum of 10 ft. of difference in the actual location of items as compared to the location shown on the drawings.
- H. All penetrations for piping, ductwork, etc. which penetrate floors, fire and/or smoke walls, roofs, full height partitions and similar structures shall be sealed by the mechanical contractor with a UL system specifically approved for the application. This system must maintain the required fire rating.

- I. All mechanical systems shall be tested and cleaned as required by Authority Having Jurisdiction.
- J. The mechanical contractor shall have the full responsibility of ensuring that his/her work is performed in a safe manner and shall bear all liability associated with his/her job site safety.
- K. Upon completion of the work, the Contractor shall notify the A/E and make arrangements for a final inspection. Contactor shall provide A/E with copy of all required balance reports prior to the final inspection.
- L. After the final inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
- M. The Contractor shall comply completely with all listed requirements within (40) days of receipt of list. Should the Contractor fail to perform within this time limit, the A/E and/or Owner reserves the right to have the work completed by others and the cost deducted from the contract price.

**END OF SECTION 23 0500**

**SECTION 23 0510**  
**BASIC HVAC MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This section includes the following basic mechanical materials and methods to complement other Division 23 Sections.
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. Mechanical Demolition.
  - 8. Concrete bases.
  - 9. Installation requirements common to equipment specification sections.

**1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, 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.

**1.4 QUALITY ASSURANCE**

- A. All piping shall be specified in this section. Material and installation shall also be subject to state, local codes and ordinances of the area encompassing this project.
- B. Delete first paragraph below if no welding. AWS states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability.
- C. Welder's Qualifications: All welder shall be qualified in accordance with ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- D. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."
- E. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## **PART 2 - PRODUCTS**

### **2.1 PIPE, TUBE, AND FITTINGS**

- A. Provide piping and factory fabricated fittings as indicated for each service and pipe size. Fitting sizes and types shall match piping or equipment connections. Where not indicated, comply with governing regulations or manufacturer's recommendations.

### **2.2 SLEEVES**

- A. The following materials are for wall, floor, slab, and roof penetrations:
  - 1. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
  - 2. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
  - 3. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
  - 4. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

### **2.3 ESCUTCHEONS**

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.

### **2.4 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.

### **2.5 CONCRETE BASES**

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

## **PART 3 - EXECUTION**

### **3.1 MECHANICAL DEMOLITION**

- A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### **3.2 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Do not run piping through electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces, if approved by local authority.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping to allow maximum possible headroom unless specific mounting heights or slopes are indicated.
- I. Install piping at indicated slopes, or level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Install piping to allow application of insulation.
- M. Select system components with pressure rating equal to or greater than system operating pressure.
- N. Install escutcheons for penetrations of walls, ceilings, and floors.
- O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials conforming to the 25/50 flame spread and smoke developed rating.
- S. Verify final equipment locations for roughing-in.
- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### **3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install 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.

**END OF SECTION 23 0510**

**SECTION 23 0593**  
**TESTING, ADJUSTING, AND BALANCING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following:
  - 1. Balancing AIRFLOW and WATER flow within distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
  - 2. Adjusting total HVAC systems to provide indicated quantities.
  - 3. Verifying that automatic control devices are functioning properly.
  - 4. Reporting results of activities and procedures specified in this Section.

**1.3 DEFINITIONS**

- A. Retain acronyms and abbreviations that remain after this Section has been edited for Project.
- B. AABC: Associated Air Balance Council.
- C. AMCA: Air Movement and Control Association.
- D. NEBB: National Environmental Balancing Bureau.
- E. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

**1.4 SUBMITTALS**

- A. Certified Testing, Adjusting, and Balancing Reports: Prepared on approved forms certified by the testing, adjusting, and balancing Agent.

**1.5 QUALITY ASSURANCE**

- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC or NEBB or Engineer's approved equal.
- B. Certification of Testing, Adjusting, and Balancing Reports: Certify testing, adjusting, and balancing field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
  - 2. Certify that testing, adjusting, and balancing team complied with approved testing, adjusting, and balancing plan and procedures specified and referenced in this Specification.
- C. Testing, Adjusting, and Balancing Reports: Use standard forms approved by the Engineer.
- D. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- E. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by the instrument manufacturer.

**1.6 PROJECT CONDITIONS**

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

**1.7 COORDINATION**

- A. Coordinate 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 testing, adjusting, and balancing activities.

- B. Provide 7 day's advance notice for each test including scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

## **PART 2 - PRODUCTS (Not Applicable)**

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine approved submittal data of HVAC systems and equipment.
- B. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- C. Examine system and equipment test reports.
- D. 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 their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- E. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- F. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- G. Examine strainers for clean screens and proper perforations.
- H. Examine hydronic equipment for correct piping connections and for clean and straight fins.
- I. Examine equipment for installation and for properly operating safety interlocks and controls.
- J. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices operate by the intended controller.
  - 2. Verify dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Sensors are located to sense only intended conditions.
  - 6. Sequence of operation for control modes is according to the Contract Documents.
  - 7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
  - 8. Interlocked systems are operating.
- K. Report to the Engineer deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

### **3.2 TESTING AND BALANCING PROCEDURES**

- A. Perform testing and balancing procedures on each system according to procedures contained in AABC national standards.
- B. Perform testing and balancing procedures on each system according to procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.



- D. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.
- E. **Coordinate outside air damper positions on all makeup air units in relation to exhaust fans with TC (see control sequences).**

### 3.3 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans: Plus 10 to minus 10 percent.
  - 2. Air Outlets and Inlets: Plus 10 to minus 10 percent.
  - 3. Water Flow Rate: 0 to minus 10 percent.

### 3.4 REPORTS

- A. 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.
- B. Final Report: Typewritten, or computer printout in letter-quality font, on standard bond paper, bound in three-ring, loose-leaf binder, and tabulated and divided into sections by tested and balanced systems.
  - 1. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing agent.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  - 3. Final Report Contents: In addition to certified field report data, include the following:
    - a. Pump curves.
    - b. Fan curves.
    - c. Manufacturers' test data.
    - d. Field quality-control test reports prepared by system and equipment installers.
    - e. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
  - 4. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
    - f. Title page.
    - g. Name and address of testing, adjusting, and balancing Agent.
    - h. Project name.
    - i. Project location.
    - j. Architect's name and address.
    - k. Engineer's name and address.
    - l. Contractor's name and address.
    - m. Report date.
    - n. Signature of testing, adjusting, and balancing Agent who certifies the report.

### 3.5 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

**END OF SECTION 23 0593**

**SECTION 23 0700**  
**HVAC SYSTEMS INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The work in this section of the specification and the accompanying drawings consists of performing all labor, equipment, accessories, and materials and in performing all operations necessary for the installation of all insulation for the duct systems and sealing of sleeves.
- B. Work to be insulated includes the following:
  - 1. All voids within roof curbs.
  - 2. All supply air, return air, transfer air, outside air, and exhaust air ducts.
  - 3. All circulating above ground hot water heat piping, valves, and fittings.
  - 4. All circulating above ground hot water air separators, and other heating water equipment as required.
  - 5. All sleeves.
- C. All insulation work shall be installed in a workmanlike manner by skilled workmen engaged in this type of work.
- D. Fire-Test-Response Characteristics: Provide products with flame-spread and smoke-developed indices of 25 and 50, respectively, according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction.

**1.3 SUBMITTALS**

- A. Shop drawings/product data as specified in Section 23 0500 shall include the following:
  - 1. Product Data: Identify thermal conductivity, thickness, and jackets (both factory installed and field applied, if any), for each type of product indicated.

**1.4 COORDINATION**

- A. Coordinate clearance requirements with duct Installer for insulation application.
- B. Coordinate clearance requirements with piping Installer for insulation application.
- C. Coordinate size and location of supports, hangers, and insulation shields.
  - 1. All hangers and insulation shields for piping shall be large enough to encompass insulation without penetrating vapor barrier.
  - 2. It shall not be acceptable for insulation to envelope hangers/saddles.
  - 3. It shall not be acceptable for insulation to terminate on either side of hangers not properly sized to encompass insulation.

**PART 2 - PRODUCTS**

**2.1 DUCTWORK INSULATION**

- A. RIGID BOARD DUCT INSULATION
  - 1. Rigid Board shall be fiberglass, CertainTeed type IB with FSK reinforced foil scrim-kraft jacket or accepted equal. Board density shall be 3 lb/cubic foot with thermal conductivity of .23 at 75 degrees F mean temperature. ASTM C 612, Class 1.
- B. FLEXIBLE DUCT INSULATION
  - 1. Flexible insulation shall be fiberglass, CertainTeed standard duct wrap with FSK reinforced foil scrim-kraft jacket or accepted equal. Flexible insulation density shall be 1-1/2 lb/cubic foot with thermal conductivity of .24 at 75 degrees F mean temperature. ASTM C 553, Type I, Class B-4.
- C. DUCTWORK INSULATION ACCESSORIES
  - 1. Provide staples, bands, wires, tape, anchors, comer angles and similar accessories as recommended by insulation manufacturer for applications indicated.

**D. DUCTWORK INSULATION COMPOUNDS**

1. Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

**E. INSULATION THICKNESS FOR DUCTWORK:** All ducts are to be insulated unless otherwise noted. Insulation thickness and type shall be as follows:

1. Packaged Makeup Air Rooftop Units with Integral Hot Water Coil:
  - a. Rectangular Supply duct insulation shall be interior and 1/2" thick.
2. Existing AHU Serving new Fan Powered VAV's 950 & 951:
  - a. Rectangular Supply duct insulation before the VAV shall be exterior and 1-1/2" thick.
  - b. Round Supply duct insulation before the VAV shall be exterior and 1-1/2" thick.
  - c. Rectangular Supply duct insulation after the VAV shall be interior and 1/2" thick.
  - d. Round Supply duct insulation after the VAV shall be exterior and 1-1/2" thick.
3. Field installed mixing box serving fan coil FC-981 shall have exterior insulation, 2" thick.
4. Rectangular Return Duct Insulation shall be interior and 1/2" thick.
5. Transfer Duct Insulation shall be interior and 1/2" thick.
6. Transfer Sleeves Insulation shall be interior and 1/2" thick.
7. Outside Air Duct Insulation shall be exterior and 2" thick.
8. Exhaust Air Duct Insulation shall be exterior and 2" thick unless otherwise noted.
  - a. Exhaust air duct serving Exhaust Fan EF-968 in Wash Bay 968 shall have 2" exterior insulation with Stucco Embossed Venture Clad 1577CW-E jacketing on all sides (Painting by Painting Contractor following Venture Clad's painting procedures).
  - b. Exhaust air duct from hose reels to inline fans to be uninsulated spiral paint grip. Exhaust air duct from inline fans to exterior wall termination to be exterior insulated, 2" thick, galvanized spiral paint grip duct. Ductwork extending 12" past exterior wall to be uninsulated galvanized spiral duct.
9. Concealed ducts may be insulated with rigid or flexible fiberglass insulation.
10. Ductwork to be paint grip:
  - a. Supply, return ductwork in Shop 977.
  - b. Exhaust Ductwork from Hose Reels to Vehicle Exhaust Fans (EF-1 thru 6) in Shop 977 (must be spiral paint grip duct).
11. Exposed ducts shall be insulated with rigid fiberglass insulation only, including ducts exposed in shop spaces.
  - a. Protective Coating: Portions of insulated duct, 84 inches or less above the floor, shall be additionally protected by the application of a layer of 20 x 20 mesh Johns-Manville "Duramesh" coated with Benjamin Foster mastic #30-36.

**2.2 CIRCULATING ABOVE GROUND HEATING PIPING INSULATION**

- A. All piping in concealed and exposed areas shall be insulated with fiberglass pipe insulation with all service jacket. Jacket shall be factory-applied, and, where specified, with white foil scrim-kraft vapor barrier. Insulation shall be Johns-Manville Micro-Lok 850 HP, or accepted equal.
- B. For pipe sizes to individual terminal units 1" and less – insulation thickness shall be 1/2". For pipe sizes of 1-1/4" thru 2" – insulation thickness shall be 1". For pipe sizes of 2-1/2" and larger – insulation thickness shall be 1-1/2".
- C. Fittings, valves, flanges, etc. shall be insulated with fiberglass blanket, Johns-Manville Microlite or pre-cut mitered sections for elbows, J-M Micro-Lok (1lb/cu. ft. density).
- D. Encase pipe fitting insulation with one piece pre-molded Zeston 2000 PVC fitting covers having flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E84 (NFPA 255) method.
- E. Provide sheet metal insulation shields at all hanger locations.

**2.3 HEATING WATER AIR SEPARATORS & OTHER HEATING WATER EQUIPMENT INSULATION**

- A. All surfaces shall be insulated with 3 lb. density fiberglass board Johns-Manville #814-450 °F at a thickness of 3".

- B. Insulation shall be cut or mitered where necessary to fit the contour of the equipment. All voids shall be packed with light density glass fiber insulation. Insulation sections shall be banded in place with  $\frac{3}{4}$  inch x 0.015 inch thick galvanized steel bands at 18 inch o.c. for all large equipment. Insulation shall be covered with one inch galvanized hexagonal wire mesh. Apply  $\frac{1}{2}$  inch of insulating cement such as OC-110 or equal in 2 layers over the wire mesh.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL APPLICATION**

- A. All insulation shall be applied on clean, dry surfaces. All joints shall be snugly butted against the adjoining piece and all joints, seams, voids, flat spots, etc., shall be filled with insulation cement. Do not use cut pieces or scraps abutting each other.
- B. Where double layers are installed, the first layer shall be fastened with binding wire. All joints shall be staggered between the two layers.
- C. Insulation on all cold surfaces must be applied in a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.
- D. All surface finishes shall be extended to protect all surfaces, ends, and raw edges of insulation.
- E. All insulation materials shall be installed in strict accordance with manufacturer's instructions, using recommended adhesives, mastics and coatings applied at specific coverage per gallon and temperature conditions.
- F. Extend insulation without interruption through walls, floors and similar penetrations, except where otherwise indicated.
- G. Maintain integrity of vapor-barrier jackets on insulation, and protect to prevent puncture or other damage.
- H. Do not apply insulation to equipment, breechings, or stacks while hot.
- I. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- J. Provide removable insulation sections to cover parts of equipment, which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.
- K. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.
- L. Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

#### **3.2 DUCT APPLICATION**

- A. Rigid Insulation shall be secured to duct or sheet metal work by impaling over pin anchors space no more than 12" centers and secured with washers and clips. Pins shall be spot welded to the duct surface by a welding procedure which will not distort the sheet metal or burn through or mar interior finish of the duct plenums of casings but which develop full strength of the pin. Pin sizes and diameters shall be as recommended by manufacturer for type and thickness of insulation specified. Insulation on the underside of all horizontal or sloping ducts shall be additionally secured with 3M Insulation Adhesive 35.
- B. Insulation shall be applied with all joints tightly butted and all points of impalement shall be pointed up and sealed with approved mastic before positioning clips. Where vapor barrier is specified, all joints, breaks, punctures and voids shall be filled with vapor barrier coating compound and covered with vapor seal material identical to the surrounding material.
- C. All joints, duct attachments, and junctions (including those caused by ducts entering walls, projections such as hanger, etc.) shall be pointed and sealed with approved mastic and taped. Where no further finish is required over the vapor barrier, taping shall be carefully done to obtain a neat finished appearance.

- D. Flexible Insulation shall be adhered to duct with fire-retardant adhesive in sufficient quantities to prevent sagging. Ducts with a width over 30" shall be further secured on the underside with mechanical fasteners on 12" maximum centers. Insulation shall be butted with facing overlapping all joints at least 2" and sealed with fire-retardant vapor barrier adhesive. Seal all breaks and punctures with vapor barrier tape and same type of fire retardant adhesive.

### **3.3 MINERAL-FIBER PIPE INSULATION APPLICATION:**

- A. Fittings, valves, and flange insulation shall be wrapped firmly under compression (minimum 2:1) to a thickness equal to the adjoining insulation, secured with No. 20 gauge galvanized annealed steel wire, and finished with a smoothing coat of mastic, Johns-Manville No. 375 Insulating and Finishing Cement or equal.
- B. Cold Fittings, Valves, Flanges, etc., shall be additionally sealed with a layer of resin coated glass mesh, such as Johns-Manville Duramesh 207 glass cloth, embedded between two 1/16" thick coats of vapor barrier coating, Benjamin Foster 30-35 or equal. Lap the sealed glass cloth at least 2" on itself and the adjoining insulation.
- C. Premolded Insulation Valve and Fitting Covers shall be installed by tack fastening, banding, or taping as required by manufacturer.
- D. Expansion Joints: For expansion joints, a tube of pipe insulation shall be fabricated that will allow the expansion joint to move within the tube. The insulating tube shall be fastened at one end of the pipe or equipment and the other end shall be free to slide over the adjacent insulated piping. Provide an aluminum jacket over the insulated pipe to provide a smooth surface on which the insulated tube may slide.
- E. Insulation Under Hangers: Pipe hangers shall encompass the insulation and shall have sheet metal saddles furnished by the Mechanical Contractor.
- F. Inserts shall be installed at all hanger locations. Inserts between the pipe and pipe hangers shall consist of 13lb/cubic foot hydrous calcium silicate pipe insulation, or wood blocking, of thickness equal to the adjoining insulation and shall be provided with vapor barriers where required. Insulation inserts shall not be less than the following lengths:
  - 1. 1/2" to 1-1/2" pipe size 10" long
  - 2. 3" to 6" pipe size 12" long
  - 3. 8" and larger pipe size 16" long
- G. On all piping the full thickness of insulation and jacket shall run continuously under the sheet metal pipe saddle and through the pipe hanger (pipe hanger shall be large enough to permit full insulation thickness.)

### **3.4 SEALING OF SLEEVES**

- A. All sleeves for pipes, ductwork, etc., furnished under Division 23 of specifications, penetrating floors, fire and/or smoke walls and full height partitions, including chase walls, shall be sealed in accordance with the following:
  - 1. All insulated services shall have the specified insulation terminated on either side of sleeve. Services which require a vapor barrier jacket shall have segment through sleeve insulated with calcium silicate having a minimum thickness same as specified for service. Vapor barrier jacket shall be uninterrupted. Entire void space between inside of sleeve and outside of duct, pipe, and/or calcium silicate insulation shall be packed with fiber insulation, conforming to HHI-521E Type 3 or HHI-558B Form A and having an ASTM fire class E-84 with fiber melt point in excess of 2000 degrees F., to a point 1/8 inch from ends of pipe sleeve. After void is packed with fiber insulation, services which are specified to be insulated shall have a section of insulation installed on each side of sleeve, insulation to be fitted tight to sleeve insulation. Balance of space in sleeve to be filled with nonhardening silicone conforming to TTS-00230 and of type which will allow 50 percent movement in one direction.
  - 2. Contractor is herein given the option to provide Pipe Shield, Inc., fire rated wall and floor sleeves for insulated and noninsulated piping in lieu of sealing sleeves as outlined above. Shields shall be installed in strict accordance with manufacturer's recommendations.

**END OF SECTION 23 0700**

**SECTION 23 0900  
CONTROLS & CONTROL SEQUENCES**

**(THIS TEMPERATURE CONTROL WORK WILL BE THE RESPONSIBILITY OF THE HVAC CONTRACTOR AND SHALL BE AN EXTENSION OF THE EXISTING DDC SYSTEM, & BE BY JOHNSON CONTROLS INC. CONTACT GREG HINTGEN AT 605-362-5315)**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. THIS TEMPERATURE CONTROL WORK WILL BE THE RESPONSIBILITY OF THE HVAC CONTRACTOR.
- B. ALL TEMPERATURE CONTROLS INSTALLED BY THIS CONTRACTOR SHALL BE FIELD INSTALLED. If there are any discrepancies, contact the engineer's office at least 7 days prior to bidding.
- C. Exact thermostats or space sensors &/OR PROTECTIVE COVERS to be located in the space shall be SUBMITTED TO & APPROVED BY SICHMELLER ENGINEERING & OWNER. Stainless steel flat plate thermostats are to be used in all data rooms, vestibules, restrooms, and corridors. Digital display thermostats with adjustable ranges are to be used in all offices, classrooms, reception areas, and shop areas.
- D. This Section includes controls & control sequences for HVAC systems, subsystems, and equipment.
- E. The work in this section of the specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install a complete Automatic Temperature Control System for the heating, ventilating, and air conditioning systems as indicated on drawings and specified herein, including minor items obviously necessary for complete and operating systems. Automatic Temperature Control System shall provide the "Sequence of Operation" as described in this section.
- F. The control system shall consist of all room sensors, floor sensors, thermostats, valves, damper operators and other accessories to fulfill the intent of the specifications. The temperature control system shall be installed by trained mechanics regularly employed by the manufacturer of the temperature control system.
- G. Each microprocessor based digital controller will be able to maintain its programmed memory in a non-volatile state during power failures without the use of batteries. All components and related temperature control components such as sensors, control valves, actuators, thermostats, control panels, etc. shall be manufactured by the same vendor.

**1.3 QUALITY ASSURANCE**

- A. Agent Qualifications: An Independent Engineer Approved Temperature Control Contractor shall provide and install all temperature controls and control sequences as specified in this section.

**1.4 PROJECT CONDITIONS**

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the trades and HVAC contractor to minimize conflicts with the Owner's operations.

**1.5 BALANCING OF SYSTEMS**

- A. The Temperature Controls Contractor shall cooperate and work with the mechanical contractors to properly balance out all mechanical systems to obtain a satisfactory working system.

## **1.6 ADJUSTMENT AND CALIBRATION OF SYSTEMS**

- A. After the system is completely installed, the Temperature Controls Contractor with the presence of the mechanical engineer shall verify the various temperature control cycles as herein specified to the satisfaction of the engineer. The Temperature Controls Contractor shall submit direct to the engineer, a tabulation of all outdoor air, mixed air, discharge air, and all room temperatures for each unit. All thermostats and their thermometers shall be calibrated after installation.

## **1.7 SUBMITTALS**

- A. Shop drawings as specified in Section 230500 shall include the following:
  - 1. All control devices, valves, dampers and auxiliary devices to be used.
  - 2. Written descriptions and diagrams to describe the operational sequences.
  - 3. Room thermostat schedule.
  - 4. Variable Frequency Drives as follows:
    - a. Refer to HVAC Motor Schedule and Mechanical Schedules on Plans for VFD's provided by TC. If there are any discrepancies or questions, contact the engineer's office prior to bidding.

## **1.8 CONTROLLERS & WEB-ACCESSED SYSTEM WITH CUSTOM COLOR GRAPHICS**

- A. Provide BACnet Controllers that are BACnet Testing Laboratory Listed. Network communication protocol used throughout entire DDC system shall be native BACnet Communication certified by the BTL open to Owner and available to other companies for use in making future modifications to DDC system.
- B. Unless otherwise specified, all equipment described below shall be controlled and monitored via a Web-accessed system. The Web-accessed system shall allow for any owner's designated personnel to change schedules and setpoints through a PC user on the Local Area Network or remotely via the Internet. This system shall provide complete custom color graphics and password protection. This system shall allow for remote monitoring, control, and troubleshooting via the Internet.
- C. Custom Graphics of Floor Plan: Display the following data:
  - 1. Equipment Designation/Label.
  - 2. Outside-Air Temperature Indication.
  - 3. Cooling or Heating/Economizer System Mode Indication.
  - 4. Zone temperature indication and setpoints.
  - 5. Alarms (as recommended by T.C.C.).

## **PART 2 - CONTROL SEQUENCES**

### **2.1 PACKAGED MAKEUP AIR ROOFTOP UNITS WITH INTEGRAL HOT WATER HEAT CONTROL**

- A. Occupied and Unoccupied cycles of operation shall be determined by the Building Automation System. During occupied operation, the MUA supply fan (factory installed VFD) will run continuously with the outside air damper open to its minimum open position (adjustable). A discharge air temperature sensor will maintain the discharge air temperature at its setting (reset based on building demand determined by space heating/economizer cooling) by modulating the outdoor air dampers in sequence with the modulating hot water reheat duct mounted coils. If outside air temperature is 55F or below, economizer cooling may be utilized. Upon a call for cooling, the outside air dampers will be modulated open beyond their minimum setting and the return air dampers will be modulated closed. If the economizer cannot satisfy the cooling requirements, economizer will be disabled and unit will resume normal operation. The outdoor air damper position and supply fan speed will be modulated to maintain a slight positive pressure in the space relative to outdoors (0.05" w.c., adj.). A mixed air low limit sensor will prevent the mixed air temperature from dropping below 55F (adj.). An outdoor air sensor will over-ride the outdoor air damper back to minimum position whenever the outdoor air temperature is above 60F (adj.). The modulating hot water 3-way heating coil valves will be proportionally modulated to maintain the discharge air temperature to satisfy the heating demand of the space. A manual reset, safety low limit freeze protection thermostat on the leaving



side of the heating coil will open the 3-way modulating hot water valve to 100% open, close the outdoor air dampers, and alarm if a freeze condition is sensed. Note: 3-way modulating valves to have normal/fail position such that hot water supply is injected into the coil loop. Fail to last position shall not be acceptable.

- B. Exhaust Makeup Air (See exhaust fan sequences): When any one of Vehicle Exhaust System Exhaust Fans EF-1,2,3,4,5,6 are enabled, modulate all makeup air units' outside air dampers to open to makeup a combined 1225 CFM (total over 3 MUA's) per exhaust fan that is enabled (if combined outside ventilation air CFM is higher than 1225 CFM when one exhaust fan is enabled, maintain outside air dampers at higher CFM). When the NO2CO system in Shop 977 is enabled, modulate all makeup air units' outside air dampers to makeup a combined 16,950 CFM. When the NO2CO system is enabled and any Vehicle Exhaust Fan is also enabled, modulate all makeup air units to 100% outside air.
- C. During Unoccupied operation the MUA supply fan will be off and the outdoor air dampers will be closed. If any space temperature in zones served by this unit fall below 60F (adj.) during the unoccupied cycle, the rooftop unit will be started with the outdoor air dampers closed and the modulating hot water coil will be controlled to supply 90F (adj.) air to the space until the zone is satisfied. This same cycle will take place during cold weather on morning warm up, except that the unit will operate heating coil in heating mode with the outside air dampers closed until the return air temperature reaches 68F (adj.).
- D. Safeties: The following device(s) will close the outdoor air damper, modulate each hot water reheat coil valve to fully open position, and send an alarm to the workstation and printer when activated: Reheat Coil low limit.
- E. Smoke detector shutdowns provide & installed by the EC signals an alarm, and stops fans when products of combustion are detected in airstream.
- F. Operator's Workstation shall display the following:
  - 1. Equipment Designation/Label.
  - 2. System occupied/unoccupied mode.
  - 3. Room/Area Served.
  - 4. Room/Area Temperature.
  - 5. Room/Area Temperature Setpoint, Occupied.
  - 6. Room/Area Temperature Setpoint, Unoccupied.
  - 7. Building Pressure Sensor Indication and Location.
  - 8. System on-off indication.
  - 9. Return air damper position.
  - 10. Return Air relative humidity indication.
  - 11. Return Air relative humidity setpoint.
  - 12. Outside Air Damper Position.
  - 13. Outside Air Temperature and Relative Humidity.
  - 14. Mixed-air temperature indication.
  - 15. Mixed-air temperature set-point.
  - 16. Economizer Mixed Air Temperature Set-Point.
  - 17. Economizer Status.
  - 18. Supply Fan Status.
  - 19. Supply Fan On-Off Command.
  - 20. Supply Fan High Static Shutdown.
  - 21. Supply Air Discharge Air-Temperature Indication.
  - 22. Supply Air Discharge Air-Temperature Set-Point.
  - 23. Supply Air Discharge Relative Humidity Indication.
  - 24. Each NO2CO detector NO2 level and CO level in PPM.
  - 25. Alarm Status (alarms as recommended by the T.C.C.).

## 2.2 EXISTING COOLING ONLY PACKAGED ROOFTOP UNIT WITH MODULATING HOT WATER REHEAT COILS CONTROL (EXG RTU-310, EXG RTU-320)

- A. Occupied and Unoccupied cycles of operation shall be determined by the Building Automation System. During occupied operation, the RTU supply fan will run continuously with the outside air damper open to its minimum open position (adjustable). A discharge air temperature sensor will maintain the discharge air temperature at its setting (reset based on building demand determined by space heating/cooling) by modulating the outdoor air dampers in sequence with the modulating hot water reheat duct mounted coils and the DX cooling. Upon a call for cooling by any of the spaces noted on the plans, the outside air dampers will be modulated open beyond their minimum setting and the return air dampers will be modulated closed. 2-way modulating control valves on hot water coils serving spaces not calling for cooling shall be proportionally modulated to maintain room neutral temperature discharge. If the economizer cannot satisfy the cooling requirements, the DX cooling will be modulated. 2-way modulating control valves on hot water coils serving spaces not calling for cooling shall be proportionally modulated to maintain room neutral temperature discharge. The outdoor air damper position and supply fan speed will be modulated to maintain a slight positive pressure in the space relative to outdoors (0.05" w.c., adj.). A mixed air low limit sensor will prevent the mixed air temperature from dropping below 55F (adj.). An outdoor air sensor will over-ride the outdoor air damper back to minimum position whenever the outdoor air temperature is above 60F (adj.). The modulating hot water 2-way reheat coil valves will be proportionally modulated to maintain the discharge air temperature to each associated zone at its setting. A manual reset, safety low limit freeze protection thermostat on the leaving side of the heating coil will open the 2-way modulating hot water valve to 100% open, close the outdoor air dampers, and alarm if a freeze condition is sensed. Note: 2-way modulating valves to have normal/fail position such that hot water supply is injected into the coil loop. Fail to last position shall not be acceptable.
- B. Minimum Outside Air Ventilation - Carbon Dioxide (CO2) Control: When in the occupied mode, the controller shall measure the zone CO2 levels in the return air duct and override normal damper operation to maintain a CO2 setpoint of 800 ppm (adj.). When zone CO2 levels are at 800 ppm or below, the outside air damper shall be closed. When CO2 levels are between 800 ppm and 1000 ppm, the outside air damper shall linearly modulate open, from closed at 800 ppm to scheduled minimum value at 1000 ppm. When CO2 levels are above 1000ppm, the outside air damper shall be set at the scheduled minimum value.
- C. During Unoccupied operation the RTU supply fan will be off and the outdoor air dampers will be closed. If any space temperature in zones served by this unit fall below 60F (adj.) during the unoccupied cycle, the rooftop unit will be started with the outdoor air dampers closed and the associated modulating hot water reheat coil will be controlled to supply 90F (adj.) air to the zone calling for heat until the zone is satisfied. This same cycle will take place during cold weather on morning warm up, except that the unit will operate all reheat coils in heating mode with the outside air dampers closed until the return air temperature reaches 68F (adj.). During unoccupied operation the DX cooling will be inoperative.
- D. Safeties: The following device(s) will close the outdoor air damper, modulate each hot water reheat coil valve to fully open position, and send an alarm to the workstation and printer when activated: Reheat Coil low limit.
- E. Existing smoke detector shutdowns, signals alarm, stops fans, and closes smoke dampers when products of combustion are detected in airstream.
- F. Operator's Workstation shall display the following:
  1. Equipment Designation/Label.
  2. System occupied/unoccupied mode.
  3. Room/Area Served.
  4. Room/Area Temperature.
  5. Room/Area Temperature Setpoint, Occupied.
  6. Room/Area Temperature Setpoint, Unoccupied.
  7. Building Pressure Sensor Indication and Location.
  8. System on-off indication.

9. Return air damper position.
10. Return Air CO2 indication.
11. Return Air CO2 setpoint.
12. Return Air relative humidity indication.
13. Return Air relative humidity setpoint.
14. Outside Air Damper Position.
15. Outside Air Temperature and Relative Humidity.
16. Mixed-air temperature indication.
17. Mixed-air temperature set-point.
18. Economizer Mixed Air Temperature Set-Point.
19. Economizer Status.
20. Supply Fan Status.
21. Supply Fan On-Off Command.
22. Supply Fan High Static Shutdown.
23. Supply Air Discharge Air-Temperature Indication.
24. Supply Air Discharge Air-Temperature Set-Point.
25. Supply Air Discharge Relative Humidity Indication.
26. Each Compressor Stage on-off indication.
27. Alarm Status (alarms as recommended by the T.C.C.).

### **2.3 DUCT MOUNTED HOT WATER HEATING COIL CONTROL**

- A. The hot water heating coil will be controlled by the space temperature sensor. On a call for heat, the 2-way modulating hot water valve will modulate open as necessary to meet the heating demand. The space served by the heating water coil is controlled in occupied and unoccupied modes as follows:
- B. OCCUPIED MODE
  1. The controller monitors the room temperature sensor and modulates the 2-way heating valve open to maintain the space temperature at occupied set point.
- C. UNOCCUPIED
  1. The controller monitors the room temperature sensor and modulates the 2-way heating valve open to maintain the space temperature at unoccupied set point.
- D. Operator Workstation:
  1. Display the following data:
    - a. Equipment Designation
    - b. Room/area served.
    - c. Room occupied/unoccupied.
    - d. Room temperature actual.
    - e. Room temperature set point, occupied.
    - f. Room temperature set point, unoccupied.
    - g. 2-Way Modulating hot water valve position as percent open.
    - h. Heating Coil Discharge Air Temperature.
    - i. Heating Coil Discharge Air Temperature Setpoint.
    - j. Alarm Status (alarms as recommended by T.C.C.).

### **2.4 COOLING ONLY FAN COIL UNIT & AIR-COOLED CONDENSING UNIT CONTROL**

- A. 24 volt return air and outside air control dampers provided & installed by VC, wired and controlled by TC. Field installed mixing box by VC. Return air and outside air dampers to operate inversely.
- B. Occupied Operation:
  1. While the space is occupied, the fan coil fan operates continuously supplying a constant volume of supply air.
  2. While there is no call for heating or cooling from any space thermostats, the fan coil fan shall run continuously with the outside air damper open to provide minimum ventilation air CFM to spaces. The DX cooling coil shall be enabled and hot water reheat coil shall be modulated as necessary to discharge room neutral temperature air.

3. Minimum Outside Air Ventilation - Carbon Dioxide (CO<sub>2</sub>) Control: When in the occupied mode, the controller shall measure the zone CO<sub>2</sub> levels in the return air duct and override normal damper operation to maintain a CO<sub>2</sub> setpoint of 800 ppm (adj.). When zone CO<sub>2</sub> levels are at 800 ppm or below, the outside air damper shall be closed. When CO<sub>2</sub> levels are between 800 ppm and 1000 ppm, the outside air damper shall linearly modulate open, from closed at 800 ppm to scheduled minimum value at 1000 ppm. When CO<sub>2</sub> levels are above 1000ppm, the outside air damper shall be set at the scheduled minimum value.
4. Cooling Mode:
  - a. When outside air is less than or equal to 55 F (economizer):
    - 1) On an increase in space temperature, modulate the outside air damper open past the ventilation minimum to increase the flow of cool outside air from the louver to the fan coil mixing box. Modulate the return air damper/outside air damper proportionally to satisfy room cooling requirements.
      - a) If one of the two spaces does not call for cooling, while the other does, the 2-way modulating control valve on the associated duct mounted reheat coil shall be proportionally modulated to maintain room neutral temperature discharge.
    - 2) On a decrease in space temperature, modulate the outside air damper closed to decrease the flow of cool outside air from the louver to the fan coil mixing box back to the ventilation minimum CFM. The 2-way modulating control valve on each duct mounted reheat coil shall be proportionally modulated to maintain room neutral temperature discharge.
  - b. When outside air is greater than 55 F:
    - 1) On an increase in space temperature, enable DX cooling on condensing unit.
      - a) If one of the two spaces does not call for cooling while the other does, the 2-way modulating control valve on the associated duct mounted reheat coil shall be proportionally modulated to maintain room neutral temperature discharge.
    - 2) On a decrease in space temperature past setpoint, disable DX cooling on condensing unit. The 2-way modulating control valve on each duct mounted reheat coil shall be proportionally modulated to maintain room neutral temperature discharge if necessary.
5. Heating Mode:
  - a. On a decrease in space temperature, the 2-way modulating control valve on the reheat coil of the space calling for heat shall be modulated to increase the discharge air temperature proportionally to the room demand.
  - b. On an increase in space temperature, modulate the 2-way modulating control valve on the reheat coil of the space calling for heat.
- C. Unoccupied mode:
  1. While the space is unoccupied, the fan coil fan is disabled and the outside air damper is closed. The fan is only enabled to supply a constant volume of supply air when there is a call for heating. During unoccupied operation, the outside air damper shall remain closed 100%.
  2. Heating Mode:
    - a. On a decrease in space temperature below unoccupied setpoint, the fan is enabled, and the 2-way modulating control valve on the reheat coil is modulated to increase the discharge air temperature proportionally to the room demand.
  3. Cooling Mode:
    - a. Cooling is disabled during unoccupied operation.
- D. Operator Workstation: Display the following data:
  1. Room/area served.
  2. Room occupied/unoccupied.

3. Room temperature.
4. Room temperature set point, occupied.
5. Room temperature set point, unoccupied.
6. Heating Occupied/Unoccupied Setpoints
7. Cooling Occupied/Unoccupied Setpoints
8. Mode indication, heating/cooling/satisfied.
9. Return Air Damper Position (% open).
10. Outside Air Damper Position (% open).
11. Return Air CO2 indication.
12. Return Air CO2 setpoint.
13. Return Air relative humidity indication.
14. Return Air temperature.
15. Outside Air temperature.
16. Mixed Air temperature.
17. Economizer Mixed Air Temperature Setpoint.
18. Economizer Status.
19. Each Heating Coil Water valve position (% open).
20. Each Heating Coil Leaving Air Temperature.
21. Each Heating Coil Leaving Air Temperature Setpoint.
22. Fan Coil Discharge Air Temperature.
23. Fan Coil Discharge Air Temperature Setpoint.
24. Fan Coil Fan Run Time (hours)
25. Condensing Unit DX Cooling Enabled/Disabled.
26. Condensing Unit Run Time (hours)
27. Alarm Status (alarms as recommended by T.C.C.).

## **2.5 SERIES FAN POWERED VARIABLE AIR VOLUME (VAV's) TERMINAL UNIT CONTROL**

### **A. Occupied mode:**

1. While the space is occupied, the VAV fan operates continuously supplying a constant volume of supply air.
  - a. When changing from unoccupied to occupied mode, VAV fan to be enabled 5 seconds prior to main air handling unit to prevent main air handler from spinning VAV fan backwards.
2. While there is no call for heating or cooling from the space thermostat, the VAV fan shall run continuously with the VAV damper modulated to the minimum ventilation CFM, and the hot water reheat coil shall be modulated as necessary to discharge room neutral temperature air.
3. Cooling Mode:
  - a. On an increase in space temperature, modulate the VAV damper open to increase the flow of cool air from the main air handling unit to VAV's maximum cooling CFM.
  - b. On a decrease in space temperature, modulate the VAV damper closed to decrease the flow of cool air from the main air handling unit to the VAV's minimum ventilation CFM. The 2-way modulating control valve on the reheat coil is proportionally modulated to maintain room neutral temperature discharge.
4. Heating Mode:
  - a. On a decrease in space temperature, modulate the VAV damper open to increase the flow of warm air from the main air handling unit to the VAV's maximum heating CFM. The 2-way modulating control valve on the reheat coil is modulated to increase the discharge air temperature proportionally to the room demand.
  - b. On an increase in space temperature, modulate the VAV damper closed to decrease the flow of warm air from the main air handling unit to the VAV's minimum ventilation CFM.

### **B. Unoccupied mode:**

1. While the space is unoccupied, the VAV fan is disabled and the VAV damper is closed. The VAV fan is only enabled to supply a constant volume of supply air when there is a call for heating. During unoccupied operation, the VAV damper remains closed 100%.

- a. When changing from unoccupied to occupied mode, VAV fan to be enabled 5 seconds prior to main air handling unit to prevent main air handler from spinning VAV fan backwards.
- 2. Heating Mode:
  - a. On a decrease in space temperature below unoccupied setpoint, the VAV fan is enabled, and the 2-way modulating control valve on the reheat coil is modulated to increase the discharge air temperature proportionally to the room demand.
- 3. Cooling Mode:
  - a. Cooling is disabled during unoccupied operation.
- C. 2-way modulating control valves to fail to last position.
- D. OPERATOR WORKSTATION
  - 1. Display the following data:
    - a. Room/area served.
    - b. Room occupied/unoccupied.
    - c. Room temperature.
    - d. Room temperature set point, occupied.
    - e. Room temperature set point, unoccupied.
    - f. Air Temperature Delivered to the VAV from the AHU.
    - g. VAV Discharge Air Temperature.
    - h. VAV damper position as percent open.
    - i. Mode indication, heating/cooling/satisfied.
    - j. Modulating hot water valve position as percent open.
    - k. Supply airflow rate, target.
    - l. Supply airflow rate, actual.
    - m. Alarm status (alarms as recommended by TC).

## 2.6 HOT WATER BOILERS & BOILER CIRCULATORS (B-1/P-1, B-2/P-2)

- 1. BAS system shall integrate with the boiler control systems as required.
- 2. Reset schedule - control heating water supply temperature in straight-line relationship for the following outside air temperature conditions:
  - a. 180 deg f (adj.) heating water when outside temperature is less than 20 deg f.
  - b. 150 deg f (adj.) heating water when outside temperature is greater than 50 deg f.
  - c. Do not allow the return (entering) water temp to be lower than minimum recommended by Boiler Manufacturer (130F adj verify with exact boiler installed).
- 3. An emergency boiler shut-down push button (provided & installed by E.C.), stops boilers when emergency pushbutton is pressed.
- 4. Boiler circulator enabled by boiler relay, combination starter/disconnect by EC.
- 5. Boiler circulators shall have a current switch to prove pump operation.
- 6. Graphic Operator's Workstation shall display the following (each water temp point represents a temperature sensor well to be installed in the heating system piping, coordinate with PC to install wells within 12" of thermometer wells by PC):
  - a. Outside-Air Temperature Indication.
  - b. Each Boiler enable/disable.
  - c. Each Boiler burner modulation.
  - d. Each Boiler Circulator Status.
  - e. Each Boiler return water temperature.
  - f. MFR's Minimum return water temperature.
  - g. Each Boiler supply water temperature.
  - h. Each Boiler Runtime.
  - i. Alarm Status (alarms as recommended by T.C.C.).

## 2.7 HOT WATER HEATING PUMPS (P-3 & P-4) CONTROL:

- A. The lead hot water heating pump shall be started by the BAS whenever there is a call for heating. The BAS shall modulate the variable frequency drive for the lead pump to maintain the desired system differential pressure according to a differential pressure sensor located as directed by the Engineer.

- B. Each of the two hot water heating pumps shall have a current switch or differential pressure switch to prove pump operation. If flow is not proven after the BAS has commanded the lead pump to start, an alarm shall be initiated at the BAS and the lag pump shall be started and its variable frequency drive shall be modulated by the BAS to maintain the desired system differential pressure. The BAS Contractor shall provide the necessary programming to lead/lag and alternate the pumps.
- C. Graphic Operator's Workstation shall display the following (each water temp point represents a temperature sensor well to be installed in the heating system piping, coordinate with PC to install wells within 12" of thermometer wells by PC):
  - 1. Equipment Designation.
  - 2. Auto or Manual Override indication.
  - 3. Differential Pressure Set-point.
  - 4. Differential Pressure Actual.
  - 5. Primary pump on-off indication.
  - 6. Primary pump speed indication.
  - 7. Back-up pump on-off indication.
  - 8. Back-up pump speed indication.
  - 9. Heating Water Supply to Building Temperature after boiler closely spaced tees.
  - 10. Heating Water Supply to Building Temperature after P-3&4.
  - 11. Heating Water Return from Building Temperature prior to boiler closely spaced tees.
  - 12. Outside-Air Temperature Indication.
  - 13. Alarm Status (alarms as recommended by T.C.C.).

## **2.8 CABINET UNIT HEATER CONTROL (CUH-X)**

- A. Cabinet unit heaters to have 3-way 2-position temperature control valve with normal/fail position to flow through coil. Normal/fail to last position shall not be acceptable.
- B. The unit heaters will be controlled by the space temperature sensor. On a call for heat, the first stage of heat shall be water flow through the coil at 100% flow with the fan disabled. If the room temperature drops more than 1 degree below setpoint after first stage heating, the fan will be enabled and hot water valve will modulate as necessary to meet the heating demand. The BAS will prevent the fan from operating unless 100 degree F. (adj.) hot water is available. The modulating control valve shall have normal (fail) position as flowing through heating coil, fail to last position shall not be acceptable
- C. OPERATOR WORKSTATION
  - 1. Display the following data:
    - a. Equipment Designation.
    - b. Room/area served.
    - c. Room occupied/unoccupied.
    - d. Room temperature.
    - e. Room temperature set point.
    - f. Modulating hot water valve position as percent open to coil.
    - g. Discharge Air Temperature.
    - h. Alarm Status (alarms as recommended by T.C.C.).

## **2.9 RADIANT CEILING PANELS & INVERTED FINNED TUBE RADIATION CONTROL**

- A. The radiation will be controlled by the space temperature sensor. On a call for heat, the 2-way 2-position normally open hot water valve will open as necessary to meet the heating demand. 2-way valve normal (fail) position to flow through coil, fail to last position shall not be acceptable. The space served by the radiation is controlled in occupied and unoccupied modes as follows:
  - 1. OCCUPIED MODE
    - a. The controller monitors the room temperature sensor and modulates the 2-way heating valve open to maintain the space temperature at occupied set point.
  - 2. UNOCCUPIED

- a. The controller monitors the room temperature sensor and modulates the 2-way heating valve open to maintain the space temperature at unoccupied set point.
- 3. Operator Workstation: Display the following data:
  - a. Equipment Designation
  - b. Room/area served.
  - c. Room occupied/unoccupied.
  - d. Room temperature.
  - e. Room temperature set point, occupied.
  - f. Room temperature set point, unoccupied.
  - g. 2-way 2-position hot water valve position.
  - h. Alarm Status (alarms as recommended by T.C.C.).

## 2.10 INFLOOR HEAT, ICE MELT & CIRCULATOR (P-5) CONTROL

- A. When the outside air temperature is 35F or below, P-5 shall be enabled, and will circulate heating water through ice melt Zones 2, 3, & 4 continuously while P-5 is enabled.
  - 1. A 3-way modulating temperature control valve shall modulate to inject heat into the infloor/ice melt loop to maintain 130F loop temperature. Normal/Fail position to circulate water through infloor/ice melt loop (see detail). If Zone 1 is not calling for heat, 3-way 2-position temperature control valve shall be positioned to bypass Zone 1 manifold.
- B. The infloor heat Zone 1 in Wash Bay 968 will be controlled by a slab stat & space temperature sensor.
  - 1. On a call for heat by either the slab stat or air stat, the infloor heat circulator P-5 shall run, the 3-way modulating temperature control valve shall modulate as necessary to meet the desired infloor loop setpoint of 130F (adj.), and the 3-way 2-position temperature control valve shall be opened to flow through Zone 1 Manifold. Normal/fail position for 3-way 2-position temperature control valve to circulate water through Zone 1 Manifold.
  - 2. Operator Workstation: Display the following data:
    - a. Outside Air Temperature.
    - b. Zone # Designation.
    - c. Room/area served.
    - d. Slab temperature indication.
    - e. Slab temperature setpoint.
    - f. Room temperature indication.
    - g. Room temperature setpoint.
    - h. 3-way modulating hot water injection valve position as percent open (%injecting heat into loop).
    - i. 3-way 2-position Zone 1 Manifold control valve position as percent open (% of flow through manifold).
    - j. Infloor Heat Circulator P-5 On-Off Indication.
    - k. Infloor Heat HWS Temperature Indication.
    - l. Infloor Heat HWS Temperature Setpoint.
    - m. Alarm status (alarms as recommended by TC).

## 2.11 EXHAUST FAN CONTROL (EF-X)

- A. EXISTING SF-316 & EF-316 – NO2CO Exhaust – Dyno 977 – TC to interface with NO2CO detector in Dyno 977 provided by VC, & enable existing supply fan SF-316 & existing exhaust fan EF-316 with signal from NO2CO detectors.
  - 1. TC to provide & install hand/auto/off switch in Shop 977 near NO2CO detector.
- B. EF-1 – Vehicle Exhaust System – Shop 977 (North West Bays) – shall operate with timer switch by EC.
  - 1. BAS to monitor fan operation. Modulate MUA-977A, 977B, & 977C outside air damper positions in unison to accommodate total number of Vehicle Exhaust fans and NO2CO Exhaust Fans enabled. Coordinate with balancer to set MUA damper positions to make up 1225 CFM per Vehicle Exhaust fan enabled (EF-1 thru 6). If NO2CO fans are enabled, and any of the Vehicle Exhaust fans 1 thru 6 is enabled, MUA outside air dampers to be 100% open.



- C. EF-2 – Vehicle Exhaust System – Shop 977 (North East Bays) – shall operate with timer switch by EC.
  - 1. BAS to monitor fan operation. Modulate MUA-977A, 977B, & 977C outside air damper positions in unison to accommodate total number of Vehicle Exhaust fans and NO2CO Exhaust Fans enabled. Coordinate with balancer to set MUA damper positions to make up 1225 CFM per Vehicle Exhaust fan enabled (EF-1 thru 6). If NO2CO fans are enabled, and any of the Vehicle Exhaust fans 1 thru 6 is enabled, MUA outside air dampers to be 100% open.
- D. EF-3 – Vehicle Exhaust System – Shop 977 (South West Bays) – shall operate with timer switch by EC.
  - 1. BAS to monitor fan operation. Modulate MUA-977A, 977B, & 977C outside air damper positions in unison to accommodate total number of Vehicle Exhaust fans and NO2CO Exhaust Fans enabled. Coordinate with balancer to set MUA damper positions to make up 1225 CFM per Vehicle Exhaust fan enabled (EF-1 thru 6). If NO2CO fans are enabled, and any of the Vehicle Exhaust fans 1 thru 6 is enabled, MUA outside air dampers to be 100% open.
- E. EF-4 – Vehicle Exhaust System – Shop 977 (South West Bays) – shall operate with timer switch by EC.
  - 1. BAS to monitor fan operation. Modulate MUA-977A, 977B, & 977C outside air damper positions in unison to accommodate total number of Vehicle Exhaust fans and NO2CO Exhaust Fans enabled. Coordinate with balancer to set MUA damper positions to make up 1225 CFM per Vehicle Exhaust fan enabled (EF-1 thru 6). If NO2CO fans are enabled, and any of the Vehicle Exhaust fans 1 thru 6 is enabled, MUA outside air dampers to be 100% open.
- F. EF-5 – Vehicle Exhaust System – Shop 977 (South East Bays) – shall operate with timer switch by EC.
  - 1. BAS to monitor fan operation. Modulate MUA-977A, 977B, & 977C outside air damper positions in unison to accommodate total number of Vehicle Exhaust fans and NO2CO Exhaust Fans enabled. Coordinate with balancer to set MUA damper positions to make up 1225 CFM per Vehicle Exhaust fan enabled (EF-1 thru 6). If NO2CO fans are enabled, and any of the Vehicle Exhaust fans 1 thru 6 is enabled, MUA outside air dampers to be 100% open.
- G. EF-6 – Vehicle Exhaust System – Shop 977 (South East Area) – shall operate with timer switch by EC.
  - 1. BAS to monitor fan operation. Modulate MUA-977A, 977B, & 977C outside air damper positions in unison to accommodate total number of Vehicle Exhaust fans and NO2CO Exhaust Fans enabled. Coordinate with balancer to set MUA damper positions to make up 1225 CFM per Vehicle Exhaust fan enabled (EF-1 thru 6). If NO2CO fans are enabled, and any of the Vehicle Exhaust fans 1 thru 6 is enabled, MUA outside air dampers to be 100% open.
- H. EF-968 – Wash Bay 968 NO2CO Exhaust – TC to interface with NO2CO detector provided by VC & enable fan with signal from detector in Wash Bay 968.
  - 1. TC to provide & install adjustable humidistat in Wash Bay to enable EF-968 when relative humidity exceeds 60% (adjustable).
  - 2. TC to provide & install hand/auto/off switch in Wash Bay 968 near thermostat/humidistat & NO2CO detector.
- I. EF-973 – Toilet 972, Women 973, Janitor 974, Men 975 Exhaust – shall operate during occupied hours as determined by the BAS System.
  - 1. D.D.C. controls shall prevent fan operation during Unoccupied Operation (as determined by the BAS).
- J. EF-977A – NO2CO Exhaust – Shop 977 (North East) – TC to interface with qty (4) NO2CO detectors in Shop 977 provided by VC, & enable fan all Shop NO2CO exhaust fans (EF-

- 977A, EF-977B, EF-977C, EF-977D, EF-977E, EF-977F) with signal from any of the (4) NO2CO detectors.
1. TC to provide & install hand/auto/off switch in Shop 977 near thermostat for MUA-977A, controls all (6) NO2CO fans.
  2. Coordinate with balancer to set MUA damper position to make up 16,950 CFM for total NO2CO exhaust system when NO2CO exhaust fans are enabled.
- K. EF-977B – NO2CO Exhaust – Shop 977 (North Center) – TC to interface with qty (4) NO2CO detectors in Shop 977 provided by VC, & enable fan all Shop NO2CO exhaust fans (EF-977A, EF-977B, EF-977C, EF-977D, EF-977E, EF-977F) with signal from any of the (4) NO2CO detectors.
1. TC to provide & install hand/auto/off switch in Shop 977 near thermostat for MUA-977A, controls all (6) NO2CO fans.
  2. Coordinate with balancer to set MUA damper position to make up 16,950 CFM for total NO2CO exhaust system when NO2CO exhaust fans are enabled.
- L. EF-977C – NO2CO Exhaust – Shop 977 (North West) – TC to interface with qty (4) NO2CO detectors in Shop 977 provided by VC, & enable fan all Shop NO2CO exhaust fans (EF-977A, EF-977B, EF-977C, EF-977D, EF-977E, EF-977F) with signal from any of the (4) NO2CO detectors.
1. TC to provide & install hand/auto/off switch in Shop 977 near thermostat for MUA-977A, controls all (6) NO2CO fans.
  2. Coordinate with balancer to set MUA damper position to make up 16,950 CFM for total NO2CO exhaust system when NO2CO exhaust fans are enabled.
- M. EF-977D – NO2CO Exhaust – Shop 977 (South East) – TC to interface with qty (4) NO2CO detectors in Shop 977 provided by VC, & enable fan all Shop NO2CO exhaust fans (EF-977A, EF-977B, EF-977C, EF-977D, EF-977E, EF-977F) with signal from any of the (4) NO2CO detectors.
1. TC to provide & install hand/auto/off switch in Shop 977 near thermostat for MUA-977A, controls all (6) NO2CO fans.
  2. Coordinate with balancer to set MUA damper position to make up 16,950 CFM for total NO2CO exhaust system when NO2CO exhaust fans are enabled.
- N. EF-977E – NO2CO Exhaust – Shop 977 (South Center) – TC to interface with qty (4) NO2CO detectors in Shop 977 provided by VC, & enable fan all Shop NO2CO exhaust fans (EF-977A, EF-977B, EF-977C, EF-977D, EF-977E, EF-977F) with signal from any of the (4) NO2CO detectors.
1. TC to provide & install hand/auto/off switch in Shop 977 near thermostat for MUA-977A, controls all (6) NO2CO fans.
  2. Coordinate with balancer to set MUA damper position to make up 16,950 CFM for total NO2CO exhaust system when NO2CO exhaust fans are enabled.
- O. EF-977F – NO2CO Exhaust – Shop 977 (South West) – TC to interface with qty (4) NO2CO detectors in Shop 977 provided by VC, & enable fan all Shop NO2CO exhaust fans (EF-977A, EF-977B, EF-977C, EF-977D, EF-977E, EF-977F) with signal from any of the (4) NO2CO detectors.
1. TC to provide & install hand/auto/off switch in Shop 977 near thermostat for MUA-977A, controls all (6) NO2CO fans.
  2. Coordinate with balancer to set MUA damper position to make up 16,950 CFM for total NO2CO exhaust system when NO2CO exhaust fans are enabled.
- P. EF-979 – Restroom 979 Exhaust – shall operate with lights by EC. TC to monitor operation.

## 2.12 DOMESTIC HOT WATER DIGITAL WATER TEMPERING SYSTEM

- A. The BAS shall integrate with the domestic hot water digital water tempering system. The BAS shall modulate the digital water tempering system mixing valve to maintain a leaving hot water temperature of 120F (sensor shall be integral to digital water tempering system), with water heater set to 140F (no DDC control of electric water heater).
- B. Operator's workstation to display the following:

1. Mixed outlet water temperature in degrees F
2. Mixed outlet water temperature setpoint in degrees F.
3. Actuator override.
4. High/low temperature alarm.

## **2.13 TRAINING**

- A. The Temperature Control Contractor shall provide (8) hours of training to the owner's representative.

## **2.14 WARRANTY**

- A. The entire control system shall be warranted for a period of 1 year from the date of beneficial use of the system.

## **PART 3 - PRODUCTS**

### **3.1 VARIABLE FREQUENCY DRIVES**

#### **A. WARRANTY**

1. Warranty shall be 24 months from the date of start-up, not to exceed 30 months from the date of shipment.
2. Warranty shall include all parts.

#### **B. GENERAL**

1. VFD shall be current rated at 8 kHz carrier frequency for VFD's 1-75 HP and 4 kHz for VFD's 100-400 HP. All HP ratings shall meet or exceed Table 430-150 of the National Electric Code. Three Phase Motor Full Load Currents, HP, Maximum Current, and Rated Voltage shall appear on the drive nameplate.
2. VFD shall not generate damaging voltage pulses at the motor terminals when applied within 500 feet of each other. Both Drive and Motor shall comply with NEMA MG1 section 30.40.4.2 which specifies these limits at a maximum peak voltage of 1600 Volts and a minimum rise time of .1 microseconds.

#### **C. CODES/STANDARDS**

1. VFD and options shall be c UL-508 listed.
2. NEMA 12 enclosed VFD shall be UL-1995 approved for mounting in conditioned air ducts and plenums.
3. The drive and options shall comply with the applicable requirement of the latest standards of ANSI, NEMA, National Electric Code NEC, NEPU-70, IEEE 519-1992, FCC Part 15 Subpart J, CE 96.

#### **D. QUALITY ASSURANCE**

1. Every VFD shall be functionally tested under motor load. During this load test the VFD shall be monitored for correct phase current, Phase voltages, and motor speed. Correct Current Limit operation shall be verified by simulating a motor overload.
2. Verification of proper factory presets by scrolling through all parameters shall be performed to ensure proper microprocessor settings. The computer port should also verify that the proper factory settings are loaded correctly in the drive.
3. All options shall be functionally tested. Proper heater coil installation in motor overload, if supplied, shall be verified.

#### **E. SERVICE**

1. Factory authorized representative start-up shall be included for each VFD provided.
2. Service engineers shall be employed by the manufacturer or be certified by the manufacturer and provide start-up service including physical inspection of drive and connected wiring and final adjustments to meet specified performance requirements.

#### **F. DRIVE FUNCTIONS**

1. An electronic overload circuit designed to protect an AC motor operated by the VFD output from extended overload operation on an inverse time basis. This Electronic overload shall be UL® and NEC recognized as adequate motor protection. No additional hardware such as motor overload relays or motor thermostats shall be required.
2. An LED display mounted on the door of the cabinet that digitally indicates:

- a. Frequency output
  - b. Voltage output
  - c. Current output
  - d. Motor RPM
  - e. Input kW
  - f. Elapsed Time
  - g. Time Stamped Fault Indication
  - h. DC Bus Volts
3. The VFD shall have the capability of riding through power dips up to 10 seconds without a controller trip depending on load and operating condition. In this extended ride through, the drive shall use the energy generated by the rotating fan as a power source for all electronic circuits.
4. RS232 Port and Windows based software for Configuration, Control, and Monitoring.
5. An isolated 0-20mA, 4-20mA or 0-4, 0-8, 0-10 volt analog speed input follower.
6. An isolated 0-10 V or 4-20 mA output signal proportional to speed or load.
- G. PROTECTIVE CIRCUITS AND FEATURES
  1. Motor current exceeds 200% of drive continuous current rating.
  2. Output phase-to-phase short circuit condition.
  3. Total ground fault under any operating condition.
  4. High input line voltage.
  5. Low input line voltage.
  6. Loss of input or output phase.
  7. External fault. (This protective circuit shall permit wiring of remote N.C. safety contact to shut down the drive). User supplied end switches, thermal switches, fire-stats, freeze-stats inputs will be connected to this VFD supplied circuit.
  8. Metal oxide varistors for surge suppression shall be provided at the VFD input terminals.
- H. GENERAL OPTIONS AND MODIFICATIONS
  1. Input line fuses shall provide protection for the input rectification circuit using Class J fuses with interrupting rating of 200,000 AIC. The series interrupting rating of the VFD and fuses shall be a minimum of 30,000 AIC and shall be stated in the VFD Instruction Manual as required by UL
  2. A main input disconnect shall mount within the standard NEMA 1 or NEMA 12 enclosure for positive power disconnect of the VFD. It shall have the capability for door padlocking.
  3. A three phase 3% impedance Input Line Reactor shall be provided to minimize drive harmonics on the AC line and protect the drive from damaging electrical system transients.
- I. INSTALLATION
  1. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the AFD's in accordance to the manufacturer's recommendation as outlined in the instruction manual.
  2. The electrical contractor shall complete power wiring. The contractor shall install the AFD's in accordance to the manufacturer's recommendation as outlined in the instruction manual.
- J. TRAINING
  1. The contractor shall provide a training session for owner's representatives
  2. The training shall be conducted by the manufacturer's authorized representative and shall include:
  3. Instructions on the proper operation of the equipment
  4. Instructions on the proper maintenance of the equipment

## **PART 4 - EXECUTION**

### **4.1 INSTALLATION**

- A. All devices in mechanical rooms shall be panel mounted whenever possible. Wiring to remote mounted devices in mechanical rooms and inaccessible spaces shall be run in conduit. Wiring

in accessible ceilings may be run with plenum rated cable providing it is securely fastened to the structural members at 4' intervals. In general, all wiring in conjunction with the automatic temperature control system shall be furnished by the Temperature Control Contractor under this section of the specifications in accordance with Division 26 of the specifications.

- B. All automatic valves shall be furnished by the Temperature Control Contractor and installed under his supervision by the Heating Contractor. All automatic dampers, not furnished with the equipment, shall be furnished by the Temperature Control Contractor and installed under his supervision by the Sheet Metal Contractor.
- C. **Room thermostats and remote sensors shall be wall mounted type and shall be mounted to match installation height of adjacent switches/sensors by EC, or where there are no adjacent switches/sensors, 46" on center above finished floor. Coordinate mounting location with EC to locate t-stats/sensors and wall switches. Thermostats and sensors shall not be mounted on outside walls.**

#### **4.2 PROJECT COMPLETION AND ACCEPTANCE**

- A. Upon completion of this project, it will be this Contractors responsibility to insure that the control system is functioning properly. The Contractor shall also insure that the control diagrams for the project are brought up to date and that they reflect the control system "as built". These control diagrams and screen shots of the various screens of the color graphics system shall be included in the Operation and Maintenance Manuals, which shall be turned over to the Owner following the acceptance of the above procedure by the A/E.

#### **4.3 ON-SITE ASSISTANCE**

- A. **ON-SITE Adjustments: Within one year of date of Substantial Completion, provide 4 hours EVERY OTHER MONTH to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions and improve efficiency. Certain off-site adjustments may be acceptable if owner and engineer approved.**

**END OF SECTION 23 0900**

**SECTION 23 2113  
HYDRONIC PIPING SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The work in this specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install complete systems listed below, including minor items obviously necessary for complete and operating systems. Piping materials and equipment specified in this Section include the following:
  - 1. All new hot water hydronic piping systems
  - 2. Pipes, fittings, and specialties.
  - 3. Special-duty valves.
  - 4. Meters and gages.
  - 5. Hydronic specialties.
- B. See Division 23 Section "Basic HVAC Materials and Methods" for general piping installation requirements.

**1.3 SUBMITTALS**

- A. Shop Drawings: Shop drawings as specified in Section 230500 shall include the following:
  - 1. Hydronic Specialties
  - 2. Natural Gas Near-Condensing Boiler-Burner Units
  - 3. Combustion Air Materials
  - 4. In Line Circulator Pumps for Boilers
  - 5. Building Hot Water Heating Pumps
  - 6. Bypass Filter Feeder & Spare Filter
  - 7. Hot Water Heating Hydronic Pipe, Valves, and Fittings
  - 8. Hot Water Expansion Tank and Air Separator
  - 9. Plastic Translucent Relief Valve Glycol Drum
  - 10. Flow Control and Strainer Valves
  - 11. Hot Water Cabinet Unit Heaters
  - 12. Inverted Finned Tube Radiation
  - 13. Hot Water Radiant Ceiling Panels
  - 14. Infloor Heat Tubing
  - 15. Infloor Heat Manifolds
  - 16. Ethylene Glycol – 35% Solution
  - 17. Heating Water Glycol Solution Analysis & Water-Treatment Program: Independent analysis of proposed and existing heating water solutions before and after work is complete to confirm proper glycol % and treatment. If solution analysis is not satisfactory, make adjustments as recommended by glycol supplier.
  - 18. Spare Parts
- B. Product Data: For each type of special-duty valve indicated. Include flow and pressure drop curves based on manufacturer's testing for diverting fittings, calibrated balancing valves, and automatic flow-control valves.
- C. Shop Drawings: Detail fabrication of pipe anchors, hangers, special pipe support assemblies, alignment guides, expansion joints and loops, and their attachment to the building structure.
- D. Detail location of anchors, alignment guides, and expansion joints and loops.
- E. Field quality-control test reports.
- F. Operation and maintenance data.

**1.4 MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work shall be as specified in Section 23 0510.

**1.5 QUALITY ASSURANCE**

- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- C. Uponor PEX-a tube and fitting systems must be installed by a trained installer. Installer must be able to provide verification from the manufacturer that the training has been completed.

## **1.6 COORDINATION**

- A. Coordinate pipe sleeve installations for foundation wall penetrations.
- B. Coordinate layout and installation of piping with equipment and with other installations.
- C. Coordinate pipe fitting pressure classes with products specified in related Sections.
- D. Coordinate with requirements for firestopping for fire and smoke wall and floor assemblies.

## **PART 2 - PRODUCTS**

### **2.1 PIPES, TUBES, AND FITTINGS**

- A. Copper Tube and Fittings:
  - 1. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
  - 2. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
  - 3. Wrought-Copper Fittings: ASME B16.22.
  - 4. Wrought-Copper Unions: ASME B16.22.
  - 5. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
  - 6. At the contractor's option, Nibco Press System or Viega may be used on domestic or hydronic water in lieu of soldered copper fittings. Fittings shall be suitable for working pressures to 200 psig CWP and maximum operating temperatures to +230 degrees F. The fitting manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of tools, marking and preparation of pipe, and installation of products. The representative shall periodically visit the job site and review contractor's installation and verify the correct procedures are being followed.
- B. Steel Pipe and Fittings:
  - 1. Steel Pipe, NPS 2 and Smaller: ASTM A 53, Type S (seamless), Grade A, Schedule 40, black steel, plain ends.
  - 2. Steel Pipe, NPS 2-1/2 through NPS 12: ASTM A 53, Type E (electric-resistance welded), Grade A, Schedule 40, black steel, plain ends.
  - 3. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53, Schedule 40, black steel; seamless for NPS 2 and smaller and electric-resistance welded for NPS 2-1/2 and larger.
  - 4. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250.
  - 5. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
  - 6. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
  - 7. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, 125, and 250; raised ground face, and bolt holes spot faced.
  - 8. Wrought-Steel Fittings: ASTM A 234 (ASTM A 234M), Standard Weight.
  - 9. Wrought-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Butt welding.
    - c. Facings: Raised face.
  - 10. Grooved Mechanical-Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47, Grade 32510 malleable iron; ASTM A 53, Type F, E, or S, Grade B fabricated steel; or ASTM A 106, Grade B steel fittings with grooves or shoulders designed to accept grooved end couplings.
  - 11. Grooved Mechanical-Joint Couplings: Ductile- or malleable-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 12. Spherical, Rubber, Flexible Connectors: Fiber-reinforced rubber body, steel flanges drilled to align with Classes 150 and 300 steel flanges; operating temperatures up to 220 deg. F and pressures up to 150 psig.
  - 13. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

C. Polyethylene PEX Pipe and Fittings:

1. 2" and smaller Cross linked Polyethylene Uponor PEX a Pipe: ASTM 877, SDR 9 with oxygen diffusion penetration per DIN 4726. Fittings consisting of Engineered polymer ASTM F 1960 Cold expansion fitting with reinforcing ring. Two piece compression fitting ASTM 877 with cold expansion fitting with reinforcing ring.
2. Groove Fittings for PEX Tube: One-piece brass F1960 cold-expansion fitting and groove fitting CSAB242-05.

**2.2 CONDENSATE DRAIN PIPING**

- A. Above Grade: Drain piping shall be type "M" copper, ASTM B 88, with cast-copper solder-joint drainage fittings, ANSI B 16.23, or wrought-copper solder joint, ANSI B 16.29, non-corrosive past flux and 50/50 tin-lead solder ASTM B 32.

1. Where permitted, schedule 40 PVC or ABS, solvent weld fittings.

**2.3 VALVES**

- A. General-Duty Valves, NPS 2 and Smaller: Bronze body, ball type, threaded ends, unless otherwise indicated. Valve pressure and temperature ratings not less than indicated and as required for system pressures and temperatures. Valve size shall be the same size as upstream pipe, unless otherwise indicated. Quarter-turn lever handle valve actuators. Extended valve stems on insulated valves.
- B. Safety Valves: Diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV.
- C. Pump Discharge Valves: 175-psig maximum working pressure, 250 deg F maximum operating temperature, cast-iron or ductile iron body, replaceable bronze disc with EPDM seat insert, bronze seat, stainless steel stem and spring, and "Teflon" packing. Valves shall have NPT, grooved or flanged connections and straight or angle pattern. Features shall include non-slam check valve with spring-loaded weighted disc, pressure taps, and calibrated adjustment feature to permit regulation of pump discharge flow, shutoff and valve design to permit repacking under full system pressure.

**2.4 METERS AND GAGES**

- A. Liquid-In-Glass Thermometers
1. Description: ASTM E 1.
  2. Range: Temperature range of 0 to 160 deg F, with 2-degree scale divisions (minus 18 to plus 70 deg C, with 1-degree scale divisions). Accuracy shall be plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
  3. Case: Die cast and aluminum finished in baked-epoxy enamel, glass front, spring secured, 9 inches long.
  4. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
  5. Tube: Red or blue reading, organic-liquid filled with magnifying lens.
  6. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
  7. Stem: Copper-plated steel, aluminum, or brass for separable socket; of length to suit installation.
- B. Bimetal Dial Thermometers
1. ASME B40.3; direct-mounting, universal-angle dial type.
  2. Case: Stainless steel with 5-inch diameter lens.
  3. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
  4. Element: Bimetal coil.
  5. Scale: Satin-faced nonreflective aluminum with permanently etched markings.
  6. Stem: Stainless steel for separable socket, of length to suit installation.
- C. Thermometer Wells
1. Description: Fitting with protective well for installation in threaded pipe fitting to hold test thermometer.
  2. Material: Brass, for use in copper piping.



3. Material: Stainless steel, for use in steel piping.
4. Extension-Neck Length: Nominal thickness of 2 inches, but not less than thickness of insulation. Omit extension neck for wells for piping not insulated.
5. Insertion Length: To extend 2 inches into pipe.
6. Cap: Threaded, with chain permanently fastened to socket.
- D. Pressure Gages
  1. Description: ASME B40.1, phosphor-bronze bourdon-tube type with bottom connection; dry type, unless liquid-filled-case type is indicated.
  2. Case: Drawn steel, brass, or aluminum with 4 1/2" diameter, glass lens.
  3. Connector: Brass, NPS 1/4.
  4. Scale: White-coated aluminum with permanently etched markings
  5. Accuracy: Grade A, plus or minimum 1 percent of middle 50 percent of scale.
  6. Range: Comply with the following:
    - a. Fluids under Pressure: Two times the operating pressure.
- E. Pressure Gage Fittings
  1. Hydronic Indicator: Brass body with four inlets and valves by Flow Conditioning Corp. (314) 878-7898 or equal.
  2. Valves: NPS 1/4 brass or stainless-steel needle type
  3. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
  4. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.
- F. Test Plugs
  1. Description: Nickel-plated, brass –body test plug in NPS 1/2 fitting.
  2. Body: Length as required to extend beyond insulation.
  3. Pressure Rating: 500 psig minimum.
  4. Core Inserts: Two self-sealing valves, suitable for inserting 1/8-inch OD probe from dial-type thermometer or pressure gage.
  5. Core Material for Air, Water, and Gas: 20 to 200 deg F (Minus 7 to plus 93 deg C), chlorosulfonated polyethylene synthetic rubber.
  6. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
  7. Test Kit: Pressure gage and adapted with probe, two bimetal dial thermometers, and carrying case.
- G. Pressure Gage and Thermometer Ranges: Approximately two times the system's operating conditions.

## 2.5 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated 1/2" full port ball valve with gooseneck down; with NPS 1/2 discharge connection and NPS 1/2 inlet connection, and chained cap hose connection.
- B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS 1/4 discharge connection and NPS 1/2 inlet connection.
- C. Heating Water Bladder Style Expansion Tanks: Welded carbon steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Provide taps for pressure gage and air-charging fitting, and drain fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Fabricate and test tank with taps and supports, and label according to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- D. High flow bypass filter feeders across the hot water pumps as indicated on the plans. Basis of design shall be Vector Industries FA-900AL with stainless steel basket & "Sock" filter bag (5 micron), or equal. Unit shall have adjustable leg set from factory; it shall not be acceptable for unit to be set on floor. Installation shall comply with manufacturer's installation requirements. Provide with one additional 5 micron filter bag for owner's use.
- E. Heating Water Air Separator: Welded black steel; ASME constructed and labeled for 125-psig minimum working pressure and 375 deg F maximum operating temperature; perforated stainless-steel air collector tube designed to direct released air automatic air vent; tangential inlet and outlet connections; threaded connections for 2-inch NPS (DN50) and smaller; flanged

connections for 2-1/2-inch NPS (DN40) and larger; threaded blow-down connection. Provide units in sizes for full-system flow capacity.

- F. Y-Pattern Strainers: 125-psig working pressure; cast-iron body (ASTM A 126, Class B), flanged ends for NPS 2-1/2 and larger, threaded connections for NPS 2 and smaller, bolted cover, perforated stainless-steel basket, and bottom drain connection.
- G. Ethylene Glycol: Industrially inhibited ethylene glycol-based heat transfer fluid, Dowtherm SR-1 (no substitutions) with de-ionized Water, with the following features:
  - 1. Industrially inhibited ethylene glycol.
  - 2. Shall have a fluorescent pink dye mixed in for leak detection.
  - 3. Easily analyzed for glycol concentration and inhibitor level.
  - 4. For systems containing more than 250 gallons of fluid, annual analysis must be provided free of charge by the fluid manufacturer.
  - 5. Fluid must pass ASTM D1384 (less than 0.5 mils penetration per year for all systems metals).
  - 6. Reserve alkalinity of the fluid must be at least 15 to provide long-term resistance to acidic pH.
  - 7. Percent volume of glycol shall be +/-2% of specified.

## **2.6 BOILER CIRCULATORS & HOT WATER & CHILLED WATER PUMPS**

- A. See section 23 2123 HVAC Hydronic Pumps.

## **2.7 BOILER COMBUSTION AIR MATERIALS & INSTALLATION**

- A. Furnish and install schedule 40 PVC combustion air for the boilers where shown on the Drawings with 90 degree elbow down with bird screen termination. Type, size, and performance shall be as per manufacturer's recommendations.
- B. Provide & install accessories as scheduled on the plans.

## **2.8 NATURAL GAS FIRED NEAR CONDENSING BOILER BURNER UNITS**

### **A. SUBMITTALS**

- 1. In accordance with Contract Documents. Minimum product data to include:
  - a. Capacities, accessories and options included with boiler.
  - b. General layout, dimensions, size and location of all required field connections.
  - c. Electrical characteristics - provide wiring diagrams that are specific to this project.
  - d. Weight and mounting loads.
  - e. Manufacturer's installation and start-up instructions.
  - f. Equipment Operation and Maintenance Manuals and control device cut-sheets.

### **B. QUALITY ASSURANCE**

- 1. Use an adequate number of skilled workers, trained and experienced in the necessary crafts, and who are completely familiar with the specified requirements, pertinent contract documents, and methods needed for proper performance of the work described therein.
- 2. Provide the services of a manufacturer's factory-authorized representative to inspect and verify proper installation of this equipment, and to provide equipment start-up and operator training.

### **C. DELIVERY, STORAGE, AND HANDLING**

- 1. In accordance with Contract Documents.
- 2. Accept equipment and accessories in Factory shipping packaging. Inspect for damage. Keep boiler in a vertical position from time of delivery to final installation.
- 3. While stored, all equipment must be protected from external elements such as inclement weather, job site construction activity, etc. Protect equipment from damage by leaving packaging in place until installation.

### **D. WARRANTY**

- 1. The boiler shall come with the warranties stated below. Warranty period shall be one (1) year from date of start-up or eighteen (18) months from date of shipment, whichever comes first.
  - a. Heat exchanger: 5-year limited warranty, and a 20-year warranty against thermal shock.
  - b. Burner: 10-year limited warranty.
  - c. All other parts: 1-year limited warranty.

### **E. MANUFACTURER**

1. Thermal Solutions Boiler, Evolution Model EVS 2000S. Refer to the Equipment Schedule in the Contract Documents for specific design and performance criteria.
  2. Or engineer prior approved equal.
- F. GENERAL REQUIREMENTS
1. Boiler
    - a. The boiler shall be a factory-packaged unit, complete with jacket, gas manifold, burner and controls mounted and wired, as specified in this Section. The boiler shall be factory assembled and fire tested. Boiler connections shall be limited to the water supply & return, relief valve and boiler drains, fuel input, electrical power, exhaust vent and air inlet (as specified/shown in contract documents).
    - b. The boiler shall be constructed in conformance to ASME Section IV and UL 795. The boiler shall bear the ASME "H" stamp and be National Board Listed for 160 psi working pressure and 250 deg F. The gas train and safety controls shall conform to requirements of UL 795 and ASME CSD-1.
    - c. The complete boiler shall be factory fire tested by the manufacturer and a copy of the fire-test report shall be supplied with the boiler.
    - d. The boiler heat exchanger shall be constructed in accordance with Section IV of the ASME code with straight copper tubes having extruded, integral fins. Fin spacing shall be at least seven (7) fins per inch. Each copper tube shall have a minimum wall thickness of .072". All tubes shall be rolled securely into the headers (top and bottom). There shall be no bolts, gaskets, "O-Rings", welding or brazing used in the header construction. Removable access plugs shall be included in the design of the heat exchanger to allow for access (cleaning and inspection) and replacement of each individual tube. The heat exchanger shall encompass the entire burner and be enclosed in stainless steel inner shells. Stainless steel "V" Baffles shall be used between each tube to provide uniform heat distribution of the flue gases across the entire heat exchanger. The heat exchanger shall be of sufficient size and design to ensure effective, non-limiting control of the water flow rate and velocity through each tube at all load levels.
    - e. **The heating surface of the heat exchanger shall be no less than 6.5 ft<sup>2</sup> per boiler horsepower. The boiler heat exchanger shall have no less than 0.80 inch of tube per 1000 btuh of input capacity. List the quantity and length of the individual tubes on the shop drawing submittal. Boiler manufacturers that do not meet the total tube length listed above with a standard boiler size shall provide a larger size unit and shall derate the burner for the capacity listed in the schedule.**
    - f. The boiler shall be contained in a minimum 16-gauge negative pressure steel jacket protected with a powder-coated finish. The boiler control panel shall be non-pressurized allowing boiler operation with any jacket panels removed. Hinge-less front and rear access panels shall be provided for easy access to the operating controls and to eliminate electrical code "swing radius" clearance issues.
    - g. The operating sound level for the boiler shall not exceed 50 dBA.
    - h. See plans for electrical input to the boiler. The manufacturer will mount the control transformer and fuses inside the boiler control panel. Single-point electrical hook-up for each boiler shall be provided. Separate power wiring and control wiring is not acceptable. A dedicated disconnect shall be provided for each boiler.
- G. Combustion System
- a. The burner shall be a radiant non-corroding ceramic burner, with no moving parts. Double-meshed screen, fiber-metal mats, aluminized or stainless steel construction of the burner will not be accepted. The burner shall fire in a full 360-degree pattern providing uniform heat transfer across the entire heat exchanger. A viewing port shall be provided for visual observation of burner performance. Burner shall require no maintenance, inspection or service.
  - b. Burner operation shall provide infinite Modulation with minimum 3:1 turn down utilizing a Variable Frequency Drive and air-fuel ratio control gas valve for dependable, repeatable modulation and precise combustion control. The boiler will

- be equipped with a non-sparking blower manufactured with a cast-aluminum housing. Dampers, linkages or a single-speed fan are not acceptable.
  - c. An interrupted-type mixed fuel/air pilot system with electric spark-to-pilot ignition shall be used. The pilot system shall use a UV scanner to prove pilot prior to energizing the main gas valves. Hot surface ignition systems and flame rods are not acceptable.
  - d. The entire ignition and firing control sequence shall be monitored by a UL approved commercial-type microprocessor based integrated flame safeguard burner control with first out fault annunciation and operating sequence and diagnostic indicator lights. The burner control shall incorporate both pre-purge and post-purge timing functions. In the event of ignition pilot and/or main flame failure a burner "lockout" will occur requiring a manual reset of the burner control. It shall also recognize the Proof of Closure switches on the gas valves (if DB&B w/POC).
  - e. The combustion air blower shall be equipped with a replaceable combustion air filter, 99% efficient to one micron to protect the burner from contamination. A delta-P type pressure switch shall be provided to alert the boiler operator of a dirty filter condition. Air inlet dampers and vacuum relief dampers are not required for proper operation. A combustion airflow switch shall be provided.
  - f. The gas train shall be UL/FM/CSD-1 compliant and capable of accepting up to 5 psi Natural Gas. Additional step down regulators will be permitted. The gas train shall consist of a pilot gas pressure regulator, high and low gas pressure switches (each with manual reset), automatic main and redundant gas valve - Motorized automatic main and redundant gas valve and a normally open vent valve in between (if DB&B) - Motorized automatic main and redundant gas valve w/ Proof of Closure contacts and a normally open vent valve in between (if DB&B w/POC), leak test valves downstream of each gas valve, a manual shut off valve upstream of burner and downstream of last gas valve. The main gas valve shall perform the functions of safety shutoff, constant pressure regulation and air-fuel ratio control.
- 2. Operating Control
  - a. The boiler shall be equipped with an onboard microprocessor based Electronic Control Module (ECM) featuring a 2-line, 16-character LCD display and user-friendly menu selections. All safety, operating and ignition controls shall be integrated in the ECM. The ECM shall include a diagnostic menu that provides an alarm history of the last ten (10) alarm messages and a low boiler inlet water temperature alarm history. The ECM shall have a user-friendly menu that allows easy selection of desired operating temperature, upper and lower temperature set-point limits, burner on/off thresholds PID control loop characteristics and local or remote operating modes. The ECM shall have an outdoor temperature reset function to allow the boiler operating temperature to vary based on outdoor air temperature. The ECM shall be capable of accepting a 0-10 vdc remote signal for changing temperature set-points and/or remote modulation control. Operating variables such as boiler inlet & outlet water temp, remote system temp, outdoor air temp, firing rate set-point, modulating percent and mixing valve demand percent are accessible on the display. The display shall also automatically present boiler sequence messages, alarms, and hold and lockout messages. Design features of the ECM shall include multi-level password security, outdoor temperature reset and DHW prioritization. The ECM shall provide for control of a dedicated boiler pump, up to two system pumps and a mixing valve to insure proper inlet water temperature to the boiler. The EMC shall be capable of providing peer-to-peer communication and lead/lag sequencing control (with auto rotation) of up to eight (8) boilers using standard RJ11 phone cables. The ECM shall also be capable of communicating with a BAS/BMS using Johnson Controls Metasys N2 communication protocol.
- 3. Water Trim
  - a. Water trim devices including an ASME rated pressure relief valve set at scheduled psig, combination water pressure and temperature gage (furnish graduated

pressure gauge scale from 1-1/2 to 3 times of pressure relief valve setting) and water flow switch to prevent burner operation during low water flow conditions shall be provided in the boiler outlet piping. An adjustable high limit temperature controller with manual reset to prevent water temperature from exceeding a safe system temperature and an Auxiliary Low Water Cutoff to provide redundant low water protection shall both be provided.

4. Vent & Intake Air Connections
  - a. The boiler shall be designed to accommodate sealed, direct, or conventional venting options. The flue duct shall be AL 29-4C, positive pressure type vent material, provided & installed by VC.
  - b. For sealed combustion, air intake piping shall be PVC that is sealed and pressure tight. Pipe must be at least the same size as the air inlet connection on the boiler.
- H. PERFORMANCE
  1. Boiler efficiency shall be as stated in the Equipment Schedule of the Contract Documents.
  2. The burner shall emit no more than 9 ppm NOx and 50 ppm CO (corrected to 3% O2) at all firing rates.
  3. Provide services of a manufacturer's authorized representative to perform combustion test including boiler firing rate, gas flow rate, heat input, burner manifold gas pressure, percent carbon monoxide, percent oxygen, percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output. Perform test at minimum, mid-range, and high fire.
- I. Provide & install accessories as scheduled on the plans.

## **2.9 FLOW CONTROL AND STRAINER VALVES**

- A. Furnish and install pressure-compensating flow control valves in a union (or flanges)/flow-control-device/ball-valve configuration. One piece configuration for valves 3" and smaller. Valves are to be installed where indicated on plans and in hot water heating piping systems, serving hot water coils. Flow control valves will be installed in the return line. All valves shall have access capability to allow field-exchange of internal components without removing valve body from pipeline. All valves shall be permanently marked to show direction of flow, flow rate, and pressure range.
- B. Furnish and install an in-line strainer for each flow control valve furnished that is 2" and smaller. Strainer to be in a union/strainer/ball valve configuration.
- C. Furnish and install as part of each flow control valve and strainer valve a Pete's plug 1/4" MPT fitting to receive either a temperature or pressure probe. Fitting shall be solid brass.
- D. Flow control valve shall be Autoflow FV Series, Griswold Controls, or approved equal.
- E. Strainer valves shall be Autoflow SV Series, Griswold Controls, or approved equal.
- F. If any flow controls are found to be installed backwards when balancing is performed, entire autoflow valve shall be replaced by this contractor.

## **2.10 HOT WATER CABINET UNIT HEATERS**

- A. Furnish and install cabinet unit heater(s) where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. Cabinet unit heater shall be factory-assembled of type as indicated on plans. The motors shall be 120 volt, single phase, multi-speed. Units shall be provided with lock type removable front access panel. Panel shall have factory baked enamel finish, color to be selected by Architect.
- C. Make all hot water heating connections. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, unions, etc.
- D. Controls, sensors, and control valve will be provided under Temperature Control Section.
- E. Power wiring will be provided under Division 26.

## **2.11 INVERTED FINNED TUBE RADIATION**

- A. The contractor shall furnish and install finned tube radiation as indicated and scheduled on the plans. Units shall be installed in a neat and workmanlike manner in accordance with the

specifications and the manufacturer's recommendations. Type, size, and performance shall be as tabulated in the schedule and on the drawings.

- B. Radiation shall be complete with heating elements, hangers, supports, and accessories. Provide end caps where cover does not butt against a partition wall.
- C. Heating Elements
  - 1. Elements shall be constructed of copper tubes expanded and rolled into cast brass headers, aluminum fins, steel side plates and fin tube supports.
  - 2. Fins shall have integral fin collars which space the fins and provide a fin-to-tube surface firmly bonded to the tube by mechanical expansion of the tube to help assure durability, eliminate the noise from loose fins and assure performance at cataloged ratings.
  - 3. All elements shall withstand 100 pounds air pressure factory tested under water.
  - 4. Elements shall be capacities and characteristics as scheduled on drawings. Lineal feet indicated shall be the actual finned length.
- D. Enclosure covers shall be as scheduled and shall be of suitable length to permit wall to wall method of installation. Back panel shall be of one piece construction and shall provide continuous support and rigid fastening of front panel. Enclosures shall have access panels for valves and shall have factory baked enamel finish color selected by Architect. Cover shall be minimum 18 gauge construction and backplate shall be minimal 20 gauge construction.
- E. Make all hot water heating connections. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, unions, etc.
- F. Controls, sensors, and control valve will be provided under Temperature Control Section.
- G. Provide & install accessories as scheduled on the plans.

## **2.12 HOT WATER RADIANT CEILING PANELS**

- A. Provide where indicated on the plans, radiant ceiling panels, including all piping, valves, etc.
- B. Panels shall be constructed of 0.032" thick aluminum face plate with 1/2" copper serpentine coil metallurgically bonded to face plate. Unit shall be covered with 1" thick, 3/4 pound density glass fiber pad in ceiling space.
- C. Panels shall be standard flat panels, size as indicated on plans, for installation in standard lay-in ceiling. Ceiling grid and suspension system will be provided under the General Section of the specification. Where indicated, provide a surface-mounting frame for surface installation. Connections between panels and valves will be insulated soft temper copper.
- D. Panel shall be unperforated with the standard white baked enamel finish.
- E. Make all hot water heating connections. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, unions, etc.
- F. Controls, sensors, and control valve will be provided under Temperature Control Section.
- G. Provide & install accessories as scheduled on the plans.

## **2.13 INFLOOR HEAT STAINLESS STEEL MANIFOLDS**

- A. Furnish and install, as shown on plans, stainless steel manifold(s) for infloor hydronic heating system. Manifolds shall be manufactured by same manufacturer as infloor heat tubing.
- B. Manifolds to be located as shown on plans. Manifolds shall have loop valves and shall be the size as shown in In-Floor Heat Manifold Detail(s).

## **2.14 SPARE PARTS**

- A. Provide Bypass Filter Feeder with one additional 5 micron "sock" filter bag for owner's use.
- B. Provide Cabinet Unit Heaters with one additional set of disposable filters.

## **PART 3 - EXECUTION**

### **3.1 PIPING APPLICATIONS**

- A. Coordinate applications below with materials specified in this Section. Pipe sizes at which joining methods change are between NPS 2 and NPS 2-1/2 (DN 50 and DN 65). Adjust this change point to suit personal preference. Soldered joints for pipes larger than NPS 2 (DN 50) may not meet system pressures.
- B. Chilled Water and Hot Water Heat Piping Systems: Type L drawn-temper copper tubing with soldered joints.

- C. Chilled Water and Hot Water Heat Piping Systems: Schedule 40 steel pipe with threaded joints and fittings for 2 inch and smaller, and with welded joints and fittings for 2-1/2 inch and larger.
- D. Chilled Water and Hot Water Heat Piping Systems: Schedule 40 steel pipe with mechanical couplings.
- E. Chilled Water and Hot Water Heat Piping Systems: Type L drawn-temper copper tubing with mechanical couplings.
- F. Chilled Water and Hot Water Piping Systems: Uponor SDR 9 PEX-A tubing with Uponor one-piece cold expansion F1960 fittings. Crimp ring fittings shall not be acceptable. Uponor fittings must be used with Uponor pipe and must meet all requirements to achieve full warranty coverage.

### **3.2 VALVE APPLICATIONS**

- A. Unless otherwise indicated, use the following general-duty valve types for applications indicated:
  - 1. Shutoff Duty: Ball, and butterfly valves.
  - 2. Throttling Duty: Ball, and butterfly valves.
- B. Install shutoff duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.
- C. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- D. Install calibrated plug or automatic flow control valves on the outlet of each heating or cooling element and elsewhere as indicated to facilitate system balancing.
- E. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.
- F. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- G. Install safety relief valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Install safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements.

### **3.3 METER AND GAGE INSTALLATION**

- A. Calibrate and install meters, gages, and accessories according to manufacturer's written instructions for applications where used.
- B. Thermometer Installation
  - 1. Install thermometers and adjust vertical and tilted positions.
  - 2. Install in the following locations:
    - a. As shown on piping details of plans.
  - 3. Install remote-reading dial thermometers in control panels with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
  - 4. Install thermometer wells in vertical position in piping tees where test thermometers are indicated.
    - a. Install with stem extending a minimum of 2 inches into fluid.
    - b. Fill wells with oil or graphite and secure caps.
- C. Pressure Gage Installation
  - 1. Install pressure gages in piping tees with pressure-gage valve located on pipe at most readable position.
  - 2. Install dry-type pressure gages in the following locations:
    - a. As shown on piping details of plans.
  - 3. Install liquid-filled-type pressure gages at suction and discharge of each pump.
- D. Install pressure-gage needle valve and snubber in piping to pressure gages.

### **3.4 HYDRONIC PIPING INSTALLATIONS**

- A. Install piping according to Section 23 0510 "Basic Mechanical Materials and Methods."
- B. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- C. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

- D. Install piping at a uniform grade of 0.2 percent upward in direction of flow. Install condensate piping at a uniform grade of ¼ inch per foot downward in direction of flow.
- E. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- F. Install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- G. Install unions in pipes 2-inch NPS (DN50) and smaller, adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated. Unions are not required at flanged connections.
- H. Install flanges on valves, apparatus, and equipment having 2-1/2-inch NPS (DN65) and larger connections.
- I. Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration-producing equipment.
- J. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger.
- K. Anchor piping for proper direction of expansion and contraction.
- L. Uponor PEX-a piping with F1960 expandable fittings shall be installed in accordance with Uponor's Hydronic Piping Design Assistance Manual to ensure a 25 year system warranty.
- M. Install in floor heat tubing as shown on plans and per manufacturer's requirements.

### 3.5 HANGERS AND SUPPORTS

- A. Piping support must account for expansion and contraction, vibration, and dead load of piping and its contents, and seismic bracing requirements.
- B. Hanger, support, and anchor devices shall comply with requirements below for maximum spacing of supports. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
    - a. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    - b. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
    - c. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
    - d. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
    - e. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
    - f. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 6. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
    - a. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
    - b. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
    - c. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
    - d. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
    - e. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
    - f. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 7. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.
  - 8. PEX-a Piping Hanger Spacing: Install hangers for PEX-a piping with the following maximum spacing:
    - a. 1 inch and below: Maximum span, 32 inches.
    - b. 1-1/2 inch and above: Maximum span, 48 inches.
  - 9. PEX-a Piping Hanger Spacing with PEX-a Support Channel: Install hangers for PEX-a piping with horizontal support channel in accordance with local jurisdiction and manufacturer's recommendations, with the following maximum spacing:
    - a. Maximum span, 8 feet.



10. PEX-a Riser Supports: Install CTS riser clamps at the base of each floor and at the top of every other floor. Install mid-story guides between each floor.
11. Pipe Joint Connections: Install per manufacturer's recommendations. Use manufacturer-recommended cold-expansion tool for F1960 connections.

### **3.6 PIPE JOINT CONSTRUCTION**

- A. Refer to Division 23 Section "Basic HVAC Materials and Methods" for joint construction requirements for soldered and brazed joints in copper tubing; threaded, welded, and flanged joints in steel piping.
- B. Mechanical Joints: Assemble joints according to fitting manufacturer's written instructions.

### **3.7 HYDRONIC SPECIALTIES INSTALLATION**

- A. Install manual (not automatic) full port ball valve operated air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. Install ball isolation valves with chained caps.
  1. Existing hot water heating system being tied into:
    - a. Prior to any proposed work, the plumbing/hydronics contractor shall provide a complete analysis of the existing hot water heating system to determine exact glycol and composition, etc. Submit analysis/recommendations to Sichmeller engineering & Owner. Owner to provide any recommended adjustments to existing.
    - b. The plumbing contractor shall be responsible for draining and storing the existing glycol solution.
    - c. The plumbing contractor shall be responsible for cleaning and flushing the new hot water heating system piping. The existing hot water heating system shall be drained as necessary for proposed tie ins and filled with new glycol solution, no cleaning and flushing on existing piping.
    - d. Upon completion of the proposed work & system flushing, the existing glycol solution shall be pumped back in along with the owner provided adjustments and proposed system solution.
    - e. After proposed work is complete, the plumbing/hydronics contractor is to provide a complete analysis of the hot water heating system to confirm proper glycol % and treatment. Submit analysis/recommendations to Sichmeller engineering & owner. If solution analysis indicates solution is not satisfactory, this contractor to make adjustments as recommended by glycol supplier & retest until analysis is satisfactory.
  2. New hot water heating system serving addition:
    - a. The plumbing contractor shall be responsible for cleaning and flushing the new hot water heating system piping prior to pumping in new heating solution/startup.
    - b. After proposed work is complete, the plumbing/hydronics contractor is to provide a complete analysis of the hot water heating system to confirm proper glycol % and treatment. Submit analysis/recommendations to Sichmeller engineering & owner. If solution analysis indicates solution is not satisfactory, this contractor to make adjustments as recommended by glycol supplier & retest until analysis is satisfactory.
  3. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

### **3.8 TERMINAL EQUIPMENT CONNECTIONS**

- A. Size for supply and return piping connections shall be same as for equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install flow control valves and strainer valves as shown on piping details.

### **3.9 FIELD QUALITY CONTROL**

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- B. Prepare hydronic piping and perform testing according to ASME B31.9. Prepare written report of testing.

### **3.10 ADJUSTING AND CLEANING**

- A. Consult with and comply with boiler manufacturer's recommendations.

- B. After completing systems installation, including outlet fittings and devices, inspect finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
- C. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens. After cleaning and flushing hydronic piping systems, but before balancing, remove disposable fine-mesh strainers in pump suction diffusers.
- D. Preparation for testing: Prepare hydronic piping in accordance with ASME B 31.9.
- E. Testing: Test hydronic piping as specified in ASME B 31.9 "Building Services Piping."
- F. System Cleaning:
  - 1. Fill the entire system with clean, fresh water and properly vent. Repair piping leaks as early in this procedure as they are discovered. Inspect existing piping system and notify engineer immediately for any leaks requiring repairs. With valves positioned by bypass the boiler and terminal equipment, start the pump to circulate water through the system. Check strainers at pumps and at terminal equipment (new and existing) frequently and clean as often as needed. If the water is extremely dirty or murky, flush continuously, using the system pump, until the water being flushed out of the pipe loop has become clear. To flush in this manner requires care to be certain that make-up water is being added fast enough to replace what is being flushed out. Accomplish this by opening the make-up water bypass valve around the automatic pressure reducer valve and adjust the manual valve so that the pump suction pressure gauge continues to indicate the same positive pressure that existed before the manual drain and make-up valves were opened. Continue for at least two hours. Once the water is clear and debris flushed out, stop the pump.
  - 2. To complete the cleaning, fill the system with fresh water, adding a cleaning agent such as trisodium phosphate (TSP). Disconnect all power to the terminal units so that they will not operate while the system is being cleaned. Then circulate cleaning solution throughout the system, with boiler controls temporarily adjusted to raise the solution temperature to about 105 deg F to 110 deg F. Do not allow the temperature to rise above 110 deg F. Alternate operation of the primary and standby pumps and circulate the warm solution for several hours. Then turn off the boiler and pump, completely drain the system, and refill with fresh water. Repeat the cleaning process only if there is indication of foreign matter still in the system or if a test of the water indicated that it is slightly acid.
  - 3. Water should be slightly alkaline, with a pH no higher than 8.0 and no lower than 7.0.
  - 4. Add glycol to hydronic piping system to provide a total of 35% by volume.
- G. Install laminated engraved placard near boilers with 1" engraved letters indicating glycol type & concentration.
- H. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.
- I. Chemical Treatment: Provide a water analysis prepared by chemical treatment supplier to determine type and level of chemicals required to prevent scale and corrosion. Perform treatment after completing system testing and retest as necessary. If solution analysis is not satisfactory, make adjustments as recommended by glycol supplier and retest as necessary until analysis is satisfactory.

### **3.11 COMMISSIONING**

- A. Fill system and perform initial chemical treatment.
- B. Check expansion tanks to determine that they are not air bound and that system is completely full of water.
- C. Perform these adjustments before operating the system:
  - 1. Open valves to fully open position. Close coil bypass valves.
  - 2. Check pump for proper direction of rotation.
  - 3. Set automatic fill valves for required system pressure.
  - 4. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  - 5. Set temperature controls so all coils are calling for full flow.
  - 6. Check operation of automatic bypass valves.

7. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.
8. Lubricate motors and bearings.

**3.12 MISCELLANEOUS CONNECTIONS**

- A. Make all hydronic connections. This includes boiler connections, connections of heating coils to equipment supplied and/or mounted under HVAC Section. This includes piping, valves, strainers, air vents, thermometers, immersion bulbs, flow switches, drains, unions, etc.
- B. Install all control valves supplied by Automatic Temperature Control Contractor.

**3.13 AUTOMATIC TEMPERATURE CONTROL**

- A. Install the automatic temperature control dampers, air flow monitoring devices, openings for air flow switches, alarms and control devices as provided by the Automatic Temperature Control Contractor. These dampers and devices shall be installed under the direct supervision of the Section 23 0900, CONTROLS & CONTROL SEQUENCES Temperature Control Contractor and in strict accordance with the manufacturer's recommendations.

**END OF SECTION 23 2113**

**SECTION 232123  
HVAC HYDRONIC PUMPS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The Work covered in this section of the Specifications is intended to include the furnishing of all equipment, materials and labor reasonably incidental to the complete operating installation of the base mounted end-suction ground loop pumps and pertaining equipment as indicated on the drawing.
- B. This Section includes the following:
  - 1. In-Line Circulator Pumps for Boilers
  - 2. Base Mounted End-Suction Pumps Rated for VFD Application.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Pump Pressure Ratings: At least equal to system's maximum operating pressure at point where installed, but not less than specified.

**1.4 SUBMITTALS**

- A. Shop Drawings: Shop drawings as specified in Section 230500 shall include the following:
  - 1. In-Line Circulator Pumps for Boilers.
  - 2. Base Mounted End-Suction Pumps Rated for VFD Application.
- B. Product Data: Include certified performance curves and rated capacities; furnished specialties; final impeller dimensions; and accessories for each pump indicated. Indicate pump's operating point on curves.
- C. Shop Drawings: Shop drawings as specified in Section 230500 shall include the following:
  - 1. Power, signal, and control wiring diagrams differentiating between manufacturer-installed wiring and field-installed wiring.
- D. Show pump layout and connections. Include Setting Drawings with templates for installing foundation and anchor bolts and other anchorages.
- E. Operation and maintenance data including startup instructions.

**1.5 QUALITY ASSURANCE**

- A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Single-Source Responsibility: Obtain each category of pumps from one source and by a single manufacturer.
- D. Provider shall be responsible for providing certified factory authorized equipment start-up and, when noted, an in the field certified training session. New pump start-up shall be for the purpose of determining pump alignment, lubrication, voltage, and amperage readings. All proper electrical connections, pump's balance, discharge and suction gauge readings, and adjustment of head, if required. A copy of the start-up report shall be made and sent to both the contractor and to the Engineer.

**PART 2 - PRODUCTS**

**2.1 IN LINE CIRCULATOR PUMPS**

- A. The contractor shall furnish and install inline pumps as illustrated on the plans and in accordance with the following specifications:
  - 1. The pumps shall be of the horizontal, permanently lubricated type, specifically designed and guaranteed for quiet operation.
  - 2. The pumps shall have a steel shaft supported by permanently lubricated, sealed precision ball bearings. The pumps are to be equipped with a water-tight seal to prevent leakage. Mechanical seal faces to be carbon on silicon carbide. The motor shall be non-overloading at any point on the pump performance curve.

3. The motor shall be of the drip-proof, sealed precision ball-bearing, quiet-operating construction. The permanent split-capacitor motor shall be equipped with thermal overload protection.
4. Pumps to be suitable for 225°F (107°C) operating temperature at 150 psig (10 bar) working pressure.

## **2.2 BASE MOUNTED END-SUCTION PUMPS RATED FOR VFD APPLICATIONS**

- A. Furnish circulating pumps rated for VFD application where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings.
- B. MANUFACTURERS
  1. The specifying engineer reserves the right to specify a primary supplier / lead spec manufacturer on all supplied schedule and specification documents. These primary suppliers have led their respective industry in research and development and their products have had proven track records in the field. These primary suppliers, in the opinion of this engineering firm, produce a superior product to the alternately listed manufacturers. The contractor may choose to supply equivalent equipment as manufactured by the alternately specified manufacturer. This alternately specified equipment shall be supplied on a deduct alternate basis and based on the approval of the supplied alternate manufacturer's submittals. The use of a primary supplier and deduct alternates protects the specifying engineer's design concept, but allows for a check-and-balance system to protect the post-commissioning owner.
  2. Contractor shall furnish new end suction long coupled pumps for chilled water and hot water heating systems as indicated on the drawings. Pumps shall manufacturer as specified under base bid. Equivalent units as manufactured by other manufacturers may be submitted as deduct alternates. Pumps shall meet types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule drawings. Pump substitutions shall be provided with connection sizes equal to those scheduled. Pump connections shall not be downsized. Pump substitutions shall not be provided at efficiencies less than those scheduled.
  3. Or engineer prior approved equal.
- C. COMPONENTS
  1. The pumps shall be long coupled, base mounted, single stage, end suction, vertical split case design, in cast iron stainless steel fitted, specifically designed for quiet operation. Suitable standard operations at 225°F and 175 PSIG working pressure or optional operations at up to 250°F and 250 PSIG working pressures. Working pressures shall not be de-rated at temperatures up to 250F. The pump internals shall be capable of being services without disturbing piping connections, electrical motor connections or pump to motor alignment.
  2. The pumps shall be composed of three separable components a motor, bearing assembly, and pump end (wet end). The motor shaft shall be connected to the pump shaft via a replaceable flexible coupling.
  3. A bearing assembly shall support the shaft via two heavy-duty regreaseable ball bearings. Bearing assembly shall be replaceable without disturbing the system piping and shall have foot support at the coupling end. Pump bearings shall be regreaseable without removal of the bearings from the bearing assembly. Thermal expansion of the shaft toward the impeller shall be prevented via an inboard thrust bearing.
  4. The bearing assembly shall have a solid SAE1144 steel shaft. A stainless steel shaft sleeve shall be employed to completely cover the wetted area under the seal.
  5. Pump shall be equipped with an internally-flushed mechanical seal assembly installed in an enlarged tapered seal chamber. Application of an internally flushed mechanical seal shall be adequate for seal flushing without requiring external flushing lines. Seal assembly shall have Buna bellows and seat gasket, stainless steel spring, and be of a carbon ceramic design with the carbon face rotating against a stationary ceramic face.
  6. Bearing assembly shaft shall connect to a stainless steel impeller. Impeller shall be both hydraulically and dynamically balanced to ANSI/HI 9.6.4-2009, balance grade G6.3 and secured by a stainless steel locking cap screw or nut.
  7. Pump should be designed to allow for true back pull-out allowing access to the pump's working components, without disturbing motor or piping, for ease of maintenance.

8. A center drop-out type coupling, capable of absorbing torsional vibration, shall be employed between the pump and motor. Pumps for variable speed application shall be provided with a suitable coupling sleeve. Coupling shall allow for removal of pump's wetted end without disturbing pump volute or movement of the pump's motor and electrical connections. On variable speed applications the coupling sleeve should be constructed of a neoprene material to maximize performance life.
9. An ANSI and OSHA rated coupling guard shall shield the coupling during operation. Coupling guard shall be dual rated ANSI B15.1 and OSHA 1910.219 compliant coupling guard and contain viewing windows for inspection of the coupling. No more than .25 inches of either rotating assembly shall be visible beyond the coupling guard.
10. Pump volute shall be of a cast iron design for heating systems with integrally cast pedestal volute support, rated for 175 PSIG with integral cast iron flanges drilled for 125# ANSI companion flanges. (Optional 250 PSIG working pressures are available and are 250# flange drilled.) Volute shall include gauge ports at nozzles, and vent and drain ports.
11. Motors shall meet scheduled horsepower, speed, voltage, and enclosure design. Pump and motors shall be factory aligned, and shall be realigned after installation by the manufacturer's representative. Motors shall be non-overloading at any point on the pump curve and shall meet NEMA specifications and conform to standards outlined in EISA 2007.
12. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area (for field grouting). The minimum base plate stiffness shall conform to ANSI/HI 1.3.8.2.1-2009 for grouted Horizontal Baseplate Design standards.
13. Pump shall be of a maintainable design and, for ease of maintenance, should use machine fit parts and not press fit components.
14. The pump(s) vibration limits shall conform to Hydraulic Institute ANSI/HI 9.6.4-2009 for recommended acceptable unfiltered field vibration limits (as measured per ANSI/HI 9.6.4-2009 Figure 9.6.4.2.3.1) for pumps with rolling contact bearings.
15. Pump manufacturer shall be ISO-9001 certified.
16. Each pump shall be hydrostatically tested 1.5 times the maximum rated working pressure and name-plated before shipment.
17. Pump shall conform to ANSI/HI 9.6.3.1-2012 standard for Preferred Operating Region (POR) unless otherwise approved by the engineer.
- D. Provide accessories as scheduled on the plans.
- E. Provide laser alignment in field per manufacturer's requirements.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas, equipment foundations, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting performance of the pumps.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.
- C. Examine supporting structure for suitable conditions where pumps are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

#### **3.2 PUMP INSTALLATION**

- A. Install pumps according to manufacturer's written installation and alignment instructions.
- B. Install pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.
- C. Support pumps and piping separately so piping is not supported by pumps.
- D. Set base mounted pumps on concrete foundation. Disconnect coupling halves before setting. Do not reconnect couplings until alignment operations have been completed.
  1. Support pump base plate on rectangular metal blocks and shims, or on metal wedges with small taper, at points near foundation bolts to provide a gap of  $\frac{3}{4}$  to 1-1/2 inches between pump base and foundation for grouting.
  2. Adjust metal supports or wedges until pump and driver shafts are level. Check coupling faces and suction and discharge flanges of pump to verify that they are level and plumb.

### **3.3 ALIGNMENT**

- A. All base mounted end suction pumps must be laser aligned in field.
- B. Align pump and motor shafts and piping connections after setting them on foundations, after grout has been set and foundation bolts have been tightened, and after piping connections have been made.
- C. Comply with pump and coupling manufacturer's written instructions.
- D. Adjust alignment of pump and motor shafts for angular and parallel alignment by 1 of 2 methods specified in the H.I.'s Standards for Centrifugal, Rotary & Reciprocating pumps, "Instructions for Installation, Operation, and Maintenance."
- E. After alignment is correct, tighten foundation bolts evenly but not too firmly. Fill base plate completely with nonshrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has cured, fully tighten foundation bolts.
- F. Alignment Tolerances: According to manufacturer's recommendations.

### **3.4 CONNECTIONS**

- A. Install shutoff valve and strainer on pump suction and check valve and shutoff valve on pump discharge, except where other arrangement is indicated.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Install valves that are the same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Retain paragraph above or first two paragraphs below if specialty valves are required for vertical in-line pumps.
- F. Install suction diffuser and shutoff valve on suction side of base-mounted pumps.
- G. Install triple-duty valve on discharge side of base-mounted pumps.
- H. Install flexible connectors on suction and discharge sides of base-mounted pumps and where indicated. Install between pump casing and valves, except where other arrangement is indicated.
- I. Install thermometers where indicated.
- J. Install pressure gages on pump suction and discharge. Install at integral pressure-gage tappings where provided.
- K. Install temperature and pressure gage connector plugs in suction and discharge piping around each pump.
- L. Install electrical connections for power, controls, and devices. Electrical power and control wiring and connections are specified in Division 26 Sections.

### **3.5 FIELD QUALITY CONTROL**

- A. Check suction piping connections for tightness to avoid drawing air into pumps.
- B. Clean strainers.
- C. Set pump controls.

### **3.6 AUTOMATIC TEMPERATURE CONTROL**

- A. Install the automatic temperature control dampers, air flow monitoring devices, openings for air flow switches, alarms and control devices as provided by the Automatic Temperature Control Contractor. These dampers and devices shall be installed under the direct supervision of the Section 23 0900, CONTROLS & CONTROL SEQUENCES Temperature Control Contractor and in strict accordance with the manufacturer's recommendations.

### **END OF SECTION 232123**

**SECTION 23 7000  
VENTILATION AND AIR CONDITIONING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. The work in this section of the specification and the accompanying drawings consists of performing all labor and furnishing of all material and equipment necessary to install air handling systems as indicated on drawings and specified herein, including minor items obviously necessary for complete and operating systems.
- B. Also included is the work involved to remove existing associated equipment, remodeling of existing systems, including connections between new and existing systems.
- C. This contractor to be responsible for all condensate drainage piping for rooftop unit.

**1.3 SUBMITTALS**

- A. Shop Drawings: Shop drawings as specified in Section 23 0500 shall include the following:
  - 1. Knob & Sprocket Balancing Damper Standoffs
  - 2. Packaged Makeup Air Rooftop Unit with Integral Hot Water Heat
  - 3. Power Roof Ventilator Exhaust Fans
  - 4. Vehicle Exhaust System Inline Exhaust Fans and Hose Reels
  - 5. Series Fan Powered VAV/Reheat Terminals
  - 6. Cooling Only Fan Coil Unit & Condensing Unit
  - 7. Duct Mounted Hot Water Heating Coils
  - 8. Stationary Louvers
  - 9. Smoke Dampers
  - 10. Control Dampers
  - 11. Registers, Grilles, Diffusers
  - 12. Filter List & Filters – At the end of the project the HVAC contractor to provide an additional set of disposable filters.
  - 13. Spare Parts

**PART 2 - PRODUCTS**

**2.1 INTERNAL DUCT INSULATION**

- A. See HVAC Systems Insulation.
- B. All internal duct insulation shall be 1/2" as specified duct liner with black fire resistant skin surface. Liner shall have an overall density of 2.0 lbs./cu. ft. Installation shall meet NFPA 90A and 90B fire resistant requirements.
- C. Apply the insulation in fabricated pieces sized to the interior duct surfaces with the black coated or denser surface exposed to the air stream. Insulation shall be firmly held in place with B.F. 85-10 or 85-60, C.M.C. 17-477, 1-C 225 fire resistant adhesive covering no less than 100% of the duct surface. Further secure insulation on the top and sides of horizontal ducts and all sides of vertical ducts with Omark or KSM capacitor discharge studs and caps on 15" centers. Secure transverse edges with capacitor discharge studs and caps on 6" centers.
- D. Duct sizes indicated on the drawings are the internal dimensions. Where insulation is applied to the inside of ducts, the metal size of the duct shall be increased to result in internal dimensions equal to that shown on the drawings.

**2.2 SHEET METAL WORK – LOW & MEDIUM PRESSURE SYSTEMS**

- A. See plans and insulation specifications for exposed ducts to be paint grip.



- B. Unless otherwise specified, construct ducts from galvanized iron fabricated and erected in a workmanlike manner. Fabricate plenums and special fittings, as shown on the Drawings, or as required. Access doors to plenums shall be double wall construction with heavy hardware. All ductwork shall be of the gauges hereinafter specified and constructed to the best grade Inland, U.S. Steel, United Sheet Metal or equal brands, heavily galvanized.
- C. Metal gauges for low and medium pressure duct systems shall be of metal gauges and reinforcing as recommended by SMACNA or as follows:

Max. Dimension of Rect.

Ducts or Dia. of Round

Galvanized Sheet

Low Pressure Ducts

Steel Gauge Number

Up thru 12"	26
Over 12" thru 30"	24
Over 30" thru 54"	22
Over 54" thru 84"	20
Over 84"	18

Maximum Dimension of

Rectangular Ducts or

Diameter of Round

Galvanized Sheet

Medium Pressure Ducts

Steel Gauge Number

Up thru 18"	24
Over 19" thru 48"	22
Over 49" thru 72"	20
Over 73" thru 96"	18

- D. Ductwork shall be constructed, braced, reinforced and sealed as recommended by ASHRAE and SMACNA. Low pressure ductwork shall be suitable for pressures up to 2 inch w.g. Medium pressure ductwork shall be suitable for pressures up to 3 inch w.g. All ductwork 18 inches and greater in width shall be cross-broken. See SMACNA requirements for proper sealing of ductwork. All supply air ductwork between VAV air handling units and VAV terminals shall be medium pressure construction.
- E. Low pressure ductwork with the longest side 36" wide and over, or medium pressure ductwork shall be constructed using Ductmate 35/25 or equal slide on systems, per Ductmate Industries Installation Procedures and Duct Construction Standards, latest edition. The non-proprietary SMACNA T-22 Flanged Connection may be used as defined on Page 1-25 and 1-37, of the 1985 SMACNA Manual, First Edition. Ductmate 35/25 may be used for transverse joint construction, 35" wide and smaller. Ductmate 440 Butyl Gasket, or equal, shall be used between all rectangular transverse flanged duct connections, Ductmate's 440 Butyl Gasket, shall be used with the Ductmate Systems. For rectangular ductwork located outdoors, exposed to weather, construct ductwork per, 'Transverse Joints Rectangular' with using a continuous metal cleat on top joints of ducts for added weather protection. Slide on systems shall be Ductmate, Ward Industries, Inc., or equal.
- F. No obstruction shall be permitted in the ductwork to retard the flow of air. If it is necessary to run a pipe or conduit through a duct, the duct size shall be increased to compensate for the obstruction.
- G. Where space permits, duct turns shall be constructed with an inside radius equal to or greater than the duct width or duct turn vanes may be used. Where space does not permit duct turns as described above, duct turn vanes shall be used.
- H. Where interior duct insulation is required, increase the duct size to maintain the free area shown on the Drawings.

- I. Provide exterior insulated drip pans, 3 inches deep, under or adjacent to all roof and wall openings including but not limited to under all intake or relief hoods and louvers. Drip pans to be soldered watertight.
- J. Power operated dampers not furnished as a component of the ventilating machines will be furnished under the Temperature Control Specifications. They shall be installed in the ductwork under this specification. Caulk around all sides of high efficiency damper frames.
- K. Flexible connections shall be installed between suction and discharge openings in fan units and the ducts with which they are connected as shown on the Drawings, to prevent transmission of vibration noises. Material shall be watertight and fire retardant canvas weighing not less than 20 ounces per square yard, or shall be glass fabric on high temperature systems where fire hazard exists. Both materials shall be approved by Underwriter's Laboratories. The flexible material shall be furnished with all necessary angles, bolts, clips or other fasteners.
- L. Furnish and install access panels in the ductwork adjacent to all motorized dampers, fire dampers, louvers, reheat coils, and equipment which may require servicing or cleaning. Panels shall be tight fitting and shall be located so as to make them easily accessible. All panels installed in insulated ductwork shall be double wall, insulated type. Panels shall be Ruskin, Air Balance, Ventlok, ADCO, or equal.
- M. Dynamic rated fire dampers shall have an 18 inch square access panel or an 18 inch long removable duct section shall be installed adjacent to dynamic rated fire dampers in addition to a smaller inspection access panel. The removable section shall be assembled using Ductmate or equal duct joints. The joint at the damper shall be assembled with plastic fastener clips. Ductwork 24 inches and wider shall have an 18 inch by 18 inch access door in lieu of removable section.
- N. Ductwork installed above UL fire rated ceiling assemblies shall be installed in strict accordance with the provisions required by the UL Design Number designated in the Underwriters Laboratories Fire Resistance Directory.
- O. All ductwork visible through the face of a register or grille shall be painted with a flat black paint.
- P. All rigid and flexible ductwork materials installed shall have composite fire and smoke hazard ratings as tested by procedures ASTM 84, NFPA 255 and UL 723 not to exceed 25 Flame Spread and 50 Smoke Developed.
- Q. Concealed low pressure round ductwork may be rigid spiral ductwork or snaplock type with adjustable elbows.
- R. All exposed round ductwork and round ductwork to the inlet of VAV terminals shall be United, Semco, Norlock, Foremost or equal, rigid spiral duct and fittings.
- S. All exposed ductwork to be PAINTGRIP and shall be United, Semco, Norlock, Foremost or equal, rigid spiral duct and fittings. Refer to architectural reflected ceiling plans.
- T. Round ductwork shall be supported at 6 feet o.c. where building framing does not provide such support. Support shall be minimum 3/4 inch metal strap suspended from the roof or framing. Flexible duct shall not exceed 8 feet in length or pass through walls. Flexible round ductwork may only be used for final connections to supply registers and diffusers and shall not be used on return or exhaust ductwork.

### **2.3 DUCT HANGERS AND SUPPORTS**

- A. Securely attach all ductwork to the building construction in a manner to be free of vibration and swaying under all conditions of operation. Hanger attachments shall be appropriate for the building structure and shall be subject to the A/E's approval. Hang ducts from beams and joist whenever possible.
- B. Ducts shall be substantially supported with hangers located according to SMACNA standards.

### **2.4 DUCT INSTALLATION**

- A. Duct sizes shown on the drawings are nominal inside dimensions. Where internal insulation is provided, duct sizes must be increased appropriately to maintain indicated inside dimensions.

- B. All ductwork will be run substantially as shown on the plans with bends and curves. Changes in size or cross section shall be made with long tapers. The A/E reserves the right to slightly change the run of certain ducts without extra cost to the Owner, if necessary to avoid unforeseen structural or other interferences.
- C. Where ducts run through bar joists or other ceiling spaces and structural, mechanical, or electrical interference is encountered, maintain same cross sectional area as indicated on plans with a maximum of 4-1/2 to 1 aspect ratio.
- D. All openings in duct for grilles, registers, etc. shall be capped dust-tight with G.I. Metal caps during the construction period.
- E. Round branch duct connections to rectangular mains shall be made with round manual balancing dampers meeting the following specifications: Dampers shall consist of a 20 ga. Galvanized steel; 3/8" square plated steel axles turning in acetal bearings. Damper shall include optional 1-1/2" standoff bracket (with extended pin) to accommodate for the thickness of external duct insulation. Dampers have quadrant operator and shall be suitable for pressures to 1.0" w.g., velocities to 2000 f.p.m. and temperatures to 180 degrees F. Testing and ratings to be in accordance with AMCA Standard 500. Basis of design is Greenheck model MBDR-50.
- F. Exhaust/relief air, and air intake ducts shall be equipped with 3" deep watertight pans to collect moisture and condensate. Seal all joints with sealant.
- G. All changes in direction shall be made with curved elbows having a centerline radius equal to 1-1/2 times the duct width. Where space conditions prevent the use of curved elbows and/or where square turns are indicated, provide square turn elbows with turning vanes. Vanes may be either commercial type ductturns or equal, or shop fabricated to conform to SMACNA standards. Vanes shall be double thickness type pre-assembled on runners before installing in each elbow. Brace adequately and avoid rough edges to prevent objectionable noise.

## **2.5 ACCESS PANELS**

- A. Provide access panels to permit inspection and maintenance of all hot water coils, motorized volume dampers, smoke dampers, control equipment, and other equipment requiring maintenance. Panels shall be located in position dictated by the equipment such that maintenance may be performed. Panels shall not be located in top side of ducts.
- B. Panels shall be attached to duct with zinc plated cam latches. 18" x 18" and smaller panels shall have a minimum of two (2) latches. Larger panels shall have a minimum of four (4) latches. Panel shall set in rigid frame with sponge rubber gasketing to prevent air leakage. Where ductwork is insulated, panels shall be of double wall construction with 1" rigid insulation fill.
- C. Where duct size permits, access panels shall be a minimum 18" x 16" or 2" smaller than duct size, whichever is smaller.

## **2.6 CURBS AND FLASHING**

- A. Curb for roof mounted equipment shall be provided by this contractor, unless otherwise specified and scheduled. This contractor shall also provide counterflashing. The counterflashing shall be galvanized sheet metal, and all joints shall be soldered watertight.
- B. Curb on all roof-mounted equipment shall be fully insulated.
- C. Curbs on equipment with fresh air intake shall be minimum 18" high.
- D. Flashing will be provided under the General Contract.
- E. Roofing work to be by the roofing contractor.
- F. Coordinate the roof slope with construction manager prior to submitting shop drawings.

## **2.7 KNOB & SPROCKET BALANCING DAMPER STANDOFFS**

- A. Provide & install all duct mounted balancing dampers with Elgen Super Standoff (or prior approved equal) with 20 gauge base construction, and push and turn knob & sprocket with position indicator. Wing nut tightener on balancing damper shall not be acceptable. See detail.

## **2.8 PACKAGED MAKEUP AIR ROOFTOP UNITS WITH INTEGRAL HOT WATER HEAT**

### **A. SUBMITTALS**

1. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements. Computer generated fan curves for each air handling unit shall be submitted with specific design operating point noted. A computer generated psychometric chart shall be submitted for each cooling coil with design points and final operating point clearly noted. Sound data for discharge, radiated and return positions shall be submitted by octave band for each unit. Calculations for required baserail heights to satisfy condensate trapping requirements of cooling coil shall be included.
2. Product Data:
  - a. Provide literature that indicates dimensions, weights, capacities, ratings, fan performance, finishes of materials, electrical characteristics, and connection requirements.
  - b. Provide data of filter media, filter performance data, filter assembly, and filter frames.
  - c. Provide manufacturer's installation instructions.

### **B. QUALIFICATIONS**

1. Manufacturer: Company specializing in manufacturing Air Handler products specified in this section must show a minimum five years documented experience and complete catalog data on total product.

### **C. SAFETY AGENCY LISTED & CERTIFICATION**

1. Air Handling units shall be cETLus safety listed to conform with UL Standard 1995 and CAN/CSA Standard C22.2 No. 236. Units shall be accepted for use in New York City by the Department of Building, MEA 342-99-E.
2. Air handler furnished with double width, double inlet (DWDI) fans and/or plenum fans where applicable, shall be certified in accordance with the central station air handling units certification program, which is based on AHRI Standard 430.
3. Air handling unit water heating & cooling coils shall be certified in accordance with the forced circulation air cooling and air heating coils certification program, which is based on AHRI Standard 410.

### **D. DELIVERY, STORAGE, AND HANDLING**

1. Deliver, store, protect and handle products to site.
2. Accept products on site on factory-furnished shipping skids. Inspect for damage.
3. Store in clean dry place and protect from construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

### **E. GENERAL DESCRIPTION**

1. Configuration: Fabricate as detailed on prints.
2. Performance: Conform to AHRI 410 and 430 Standards. See schedules on prints. (NOTE: Above does not apply to fan array)
3. Acoustics: Sound power levels (dB) for the unit shall not exceed the specified levels shown on the unit schedule. The manufacturer shall provide the necessary sound treatment to meet these levels if required.

### **F. UNIT CONSTRUCTION**

1. Fabricate unit with heavy gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
2. Panels and access doors shall be constructed as a 2-inch nominal thick; thermal broke double wall assembly, injected with foam insulation with an R-value of not less than R-13.
  - a. Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM

D1654, having a mean scribe creepage not exceeding 1/16" at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

- b. The inner liner shall be constructed of G90 galvanized steel.
- c. The floor plate shall be constructed as specified for the inner liner.
- d. Unit will be furnished with solid inner liners.
3. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum 5 inches of positive or 6 inches of negative static pressure. Deflection shall be measured at the panel midpoint.
4. The casing leakage rate shall not exceed 0.50 cfm per square foot of casing surface area at design static pressure up to a maximum of +5" w.c. in positive pressure sections and -6" w.c. in negative pressure sections (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure)
5. Module to module field assembly shall be accomplished with an overlapping, full perimeter internal splice joint that is sealed with bulb type gasketing on both mating modules to minimize on-site labor and meet indoor air quality standards.
6. Access doors shall be flush mounted to cabinetry, with minimum of two six inch long stainless steel piano-type hinges, latch and full size handle assembly. Access doors shall swing outward for unit sections under negative pressure. Access doors on positive pressure sections, shall have a secondary latch to relieve pressure and prevent injury upon access.
7. Provide cross broke roofcap system to divert water from the top surface of the air handler. The rain shed roofcap shall have 2"standing seams covered with splice cap channels to seal top seam. Splice cap shall break down over sides of standing seam to protect the ends of the seam.
  - a. Heating coil piping vestibule 18" deep shall be factory installed of standard cabinet construction on the coil connection side of the unit. Roofcap over vestibule shall be a continuous single piece covering both the coil section and the vestibule. Roofcap seams between coil section and vestibule are not allowed.
8. The unit shall have a 6-inch curb ready base for structural rigidity and condensate trapping. The curb-ready base shall be designed with sloped drip pans located under all unit sections except duct openings and shall be supported by frame member.
9. An insulated, double-walled piping vestibule, 18" deep, shall be factory installed of standard cabinet construction on the coil connection side of the unit. Roofcap over vestibule shall be a continuous single piece covering both the coil section and the vestibule. Roofcap seams between coil section and vestibule are not allowed.

#### G. FAN ASSEMBLIES

1. Acceptable fan assembly shall be a single width, single inlet, class II, direct-drive type plenum fan dynamically balanced as an assembly, as shown in schedule. Maximum fan RPM shall be below first critical fan speed. Fan assemblies shall be dynamically balanced by the manufacturer on all three planes. Provide access to motor and fan assembly through hinged access door.
2. Fan and motor shall be mounted internally on a steel base. Factory mount motor on slide base that can be slid out the side of the unit if removal is required. Provide access to motor, drive, and bearings through hinged access door. Fan and motor assembly shall be mounted on 2" deflection spring vibration type isolators inside cabinetry.

#### H. BEARINGS, SHAFTS, AND DRIVES

1. Bearings: Basic load rating computed in accordance with AFBMA - ANSI Standards. The bearings shall be provided on the motor with the fan wheel mounted directly on the motor shaft, AMCA arrangement 4.
2. Shafts shall be solid, hot rolled steel, ground and polished, keyed to shaft, and protectively coated with lubricating oil. Hollow shafts are not acceptable.
3. The fan wheel shall be direct coupled to the motor shaft. The wheel width shall be determined by motor speed and fan performance characteristics.

**I. ELECTRICAL**

1. The air handler(s) shall be ETL and ETL-Canada listed by Intertek Testing Services, Inc. Units shall conform to bi-national standard ANSI/UL Standard 1995/CSA Standard C22.2 No. 236.
2. Fan motors shall be manufacturer provided and installed, Open Drip Proof, premium efficiency (meets or exceeds EPA requirements), 1750 RPM, single speed, 460V / 60HZ / 3P. Complete electrical characteristics for each fan motor shall be as shown in schedule.
3. Wiring Termination: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclosed terminal lugs in terminal box sized to NFPA 70.
4. Manufacturer shall provide ASHRAE 90.1 Energy Efficiency equation details for individual equipment to assist Building Engineer for calculating system compliance.
5. Installing contractor shall provide GFI receptacle within 25 feet of unit to satisfy National Electrical Code requirements.
6. Air handler manufacturer shall provide, mount and wire ABB variable speed drive with electrical characteristics such as indicated on project schedule and shown on manufacturer's data sheets.

**J. FILTERS**

1. Furnish angled filter in mixing box section with 2-inch MERV 8 filter. Provide side loading and removal of filters.
2. Filter media shall be UL 900 listed, Class I or Class II.

**K. ADDITIONAL SECTIONS**

1. Mixing box section shall be provided with end outside air opening and bottom return air opening with or without parallel low leak airfoil damper blades. Dampers shall be hollow core galvanized steel airfoil blades, fully gasketed and have continuous vinyl seals between damper blades in a galvanized steel frame. Dampers shall have stainless steel jamb seals along end of dampers. Connecting linkage and ABS plastic end caps shall be provided when return and outside air dampers are each sized for full airflow. Return and outside air dampers of different sizes must be driven separately. Damper Leakage: Leakage rate shall be less than two tenths of one percent leakage at 2 inches static pressure differential. Leakage rate tested in accordance with AMCA Standard 500.

**L. INSTALLATION**

1. Provide & install minimum 18" tall, fully insulated knockdown curb with duct support rails. Install in accordance with manufacturer's instructions.

**M. INSTALLATION**

1. Install in accordance with manufacturer's Installation & Maintenance instructions.

**N. ENVIRONMENTAL REQUIREMENTS**

1. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

**O. EXTRA MATERIALS**

1. Provide one extra set of filters for each unit as shown on project schedule.

**2.9 POWER ROOF VENTILATORS**

- A. Furnish and install power roof ventilator where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Provide & install accessories as scheduled on the plans.
- B. Spun aluminum exhaust fans shall be belt or direct drive type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure.
- C. Motors shall be heavy duty ball bearing type, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of

heavy gauge steel. Motors and drives shall be constructed of heavy gauge steel. Motors and drives shall be mounted on vibration isolators, out of the air stream. Fresh air for motor cooling shall be drawn into the motor compartment through a large space between the fan shroud and the motor cover. Motors and drives shall be readily accessible for maintenance.

- D. Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L10) life in excess of 100,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the cast type, keyed and securely attached to the wheel and motor shafts.
- E. Motor pulleys shall be adjustable for final system balancing. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment. A conduit chase shall be provided through the base to the motor compartment for ease of electrical wiring.
- F. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.
- G. Provide and install options and accessories as described in schedule.
- H. All power roof ventilator exhaust fan drops to have fully insulated field installed 3" deep watertight drip pan.

## **2.10 VEHICLE EXHAUST SYSTEM INLINE EXHAUST FANS AND HOSE REELS**

- A. General
  - 1. The contractor shall supply the installation for the complete hose reel system. This system shall include, but is not limited to, overhead duct and fittings, flexible tubing set, hose reel, exhaust fan and exhaust stack or vent. All materials and labor required for the complete installation of the system shall be included in the bid.
  - 2. The overhead duct shall be installed at the locations as indicated on floor plan. The rigid duct shall be mounted and supported in an approved manner such that it meets all local and federal guide lines. All elbows, fittings, and transitions shall be made according to SMACNA standards. The rigid duct shall be connected to the exhaust fan by means of a flexible connector to minimize noise and vibration. The flexible tubing set shall be attached to the rigid duct using a hose clamp.
- B. Automatic Spring Operated Hose Reels:
  - 1. Hose reels to be Central Pointe Inc. 32" retractable hose reels, 6"x40' flexible exhaust hose and end nozzle with rag guard, cross support bar, rubber protector and internal damper for each hose reel. Materials only contact – Mike Paskewitz, Central Pointe, Inc. (866-574-4040, mike@centralpointeinc.com)
  - 2. Manual Hose Reels shall be engineered to provide years of simple, dependable performance. This spring-operated reel shall include a ratcheting mechanism, which is used to hold the flexible tubing at the worker's desired height. Because of the spring and ratchet mechanism, no outside power source is required to raise and lower the exhaust hose.
  - 3. Reels shall be designed to handle up to 40 feet of 6" diameter hose, and shall be able to be mounted in a variety of different positions.
  - 4. The hose reel shall be spring operated type with flexible tubing set.
  - 5. The hose reel shall be supplied with a hose guide to keep the hose uniform over the drum as it retracts.
  - 6. The reel shall be constructed of a 14 gauge galvanized steel drum, 16 gauge galvanized steel reinforced side plates, and an 11 gauge galvanized steel frame.
  - 7. The locking mechanism shall be constructed of light weight cast aluminum.
  - 8. The flexible tubing set shall consist of a length of flexible tubing, hose clamps, hose stop, and exhaust adapter.
  - 9. The flexible tubing shall be constructed of high temperature silicone coated fiberglass rated to a minimum of 600F.

10. All components of the flexible tubing assembly shall be made by a stainless steel hose clamp that is riveted to establish a permanent connection.
- C. Ductwork between hose reels and inline exhaust fans to be spiral paint grip, painting by painting contractor. Ductwork downstream of inline exhaust fan to be insulated galvanized spiral duct. Galvanized spiral duct to extend 12" beyond exterior wall with back draft flapper (uninsulated on exterior ductwork).

## 2.11 VAV/REHEAT TERMINALS

- A. Submittals
  1. Product Data shall be provided with data indicating configuration, general assembly, and materials used in fabrication, including catalog performance ratings that indicate air flow, static pressure, NC designation, electrical characteristics, and connection requirements.
  2. Shop Drawings shall indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
    - a. Manufacturer shall include schedules listing discharge and radiated sound power level for each of the second through seventh octave bands (125 – 4000 Hertz) at specified differential static pressures.
  3. Certificates shall be issued to certify that the air coil capacities, pressure drops, and selection procedures meet or exceed specified requirements or coils are tested and rated in accordance with AHRI 410.
  4. Manufacturer's Installation Instructions shall indicate support and hanging details, installation instructions, and recommendations.
  5. Project Record Documents shall record actual locations of units and controls components and locations of access doors.
  6. Operation and Maintenance Data shall include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.
  7. Manufacturer's warranty shall be submitted and ensure forms have been completed in Owner's name and registered with manufacturer.
  8. Maintenance Materials shall be furnished for the Owner's use in maintenance of the project.
    - a. Extra Filters: Furnish one spare filter as required per unit.
- B. Quality Assurance
  1. Manufacturer Qualifications shall be specified in this section, with minimum ten years of documented experience.
  2. Product Listing Organization Qualifications: The manufacturer shall be listed with an organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- C. Warranty
  1. Provide 18 month manufacturer warranty from date of shipment for air terminal units, and integral heating coils.
- D. Series Fan-Powered Units
  1. Basis of Design: Price Industries, Inc.
    - a. Constant-Volume Series Fan-Powered Unit: FDC (direct digital controls).
  2. Performance Requirements:
    - a. The assemblies shall be pressure independent and shall reset to any air flow between zero and the maximum cataloged air volume. Sound ratings of air distribution assemblies shall not exceed scheduled values.
  3. General:
    - a. The manufacturer shall supply factory-assembled and wired, AHRI 880 rated, horizontal fan-powered terminal units with blower, motor, mixing plenum, and primary air damper contained in a single unit housing.
- E. Constant Volume Series Fan Powered Units (Price Model FDC)
  1. Description:



- a. Furnish and install Price model FDC series fan powered terminal unit in the sizes and configurations as indicated on the plans.
2. Unit Casing:
  - a. The unit casing shall be constructed of galvanized steel with a minimum material thickness of 20 gauge. The discharge panel shall be constructed of 18 gauge galvanized steel for increased rigidity and sound attenuation.
  - b. Primary air inlet collar: Manufacturer shall provide round inlet collars, suitable for standard flexible duct sizes.
  - c. Unit Discharge: Manufacturer shall provide rectangular unit discharges, suitable for flanged duct connection.
  - d. Liners:
    - 1) Standard:
      - a) Fiberglass Liner - FG.
        1. Insulation shall comply with the requirements of UL 181 (erosion), ASTM C1338 (fungi resistance), ASHRAE 62.1, and ASTM C1071, having a maximum flame/smoke spread of 25/50 for both the insulation and the adhesive when tested in accordance with ASTM E84.
        2. The insulation shall be secured with adhesive.
        3. Insulation edges exposed to the airstream shall be coated with NFPA 90A approved sealant.
        4. Insulation thickness shall be 1 inch thick, R-value of 4.1.
3. Primary Air Damper Assembly:
  - a. The damper assembly shall be heavy-gauge, galvanized steel with a solid shaft rotating in bushings.
  - b. The damper shaft shall incorporate a visual position indicator etched into the end of the damper shaft to clearly indicate damper position over the full range of 90 degrees.
  - c. The low leakage 18 gauge damper assembly shall incorporate a peripheral gasket on the damper blades for tight airflow shutoff.
    - 1) Air leakage past the closed damper shall not exceed two percent of the unit maximum airflow at 3 inch water gauge inlet static pressure, tested in accordance with ASHRAE 130.
    - 2) The damper, seal and bushing system shall be tested to 1.25 million cycles, or the equivalent of 100 full open/closures per day for 35 years, with no visible signs of wear, tear, or failure of the damper assembly after such testing.
  - d. Airflow Sensor:
    - 1) The airflow sensor shall be a differential pressure airflow device measuring total and static pressure, and shall be mounted to the inlet valve.
    - 2) Plastic parts shall be fire-resistant, complying with UL 94.
    - 3) The airflow sensor shall be RoHS (Restriction of Hazardous Substances) compliant. Materials containing polybrominated compounds shall not be acceptable.
    - 4) Control tubing shall be protected by grommets at the wall of the airflow sensor's housing.
    - 5) The airflow sensor shall be furnished with a minimum of twelve total pressure sensing ports and four static sensing ports, and shall include a center averaging chamber that amplifies the sensed airflow signal.
    - 6) The airflow sensor signal accuracy shall be plus or minus five percent throughout terminal operating range.
  - e. Inlet Valve:
    - 1) The inlet valve shall be a consistent diameter to retain flex duct and provide a stop for hard duct.
    - 2) The inlet valve shall include a 1/8 inch raised single bead weld for added strength.

- 3) The gasket seal shall be a low leakage continuous piece with a peripheral gasket for tight airflow shutoff.
    - 4) The inlet valve shall include two heavy duty stop pins to accurately position the damper in the open and closed position.
  4. Fan: The terminal unit shall be supplied with a forward curved, centrifugal type fan.
  5. Fan Motor:
    - a. The fan motor shaft shall be directly connected to the fan.
    - b. The fan shall be isolated from the casing to prevent transmission of vibration, with the following motor type (select one):
      - 1) Electrically Commutated Motor (ECM):
        - a) Brushless DC controlled by an integrated controller/inverter that operates the wound stator and senses rotor position to electrically commutate the stator. The motor shall be supplied with a speed controller for balancing purposes. The speed controller shall have dual outputs to control up to two motors, and allow for manual dial motor speed adjustment, or a 2-10 VDC signal for variable speed control.
        - b) Permanent magnet type motor with near-zero rotor losses designed for synchronous rotation.
        - c) Designed to maintain a minimum 70 percent efficiency over the entire operating range.
        - d) The ECM shall be furnished with factory programming:
          5. Pressure Independent Program
            - i. A pressure independent program shall be provided to allow the ECM to compensate for fluctuations in external static pressure, providing constant airflow.
            - ii. The air volume flow rate shall be maintained to within five percent of desired flow in a system with up to 0.50 inches water gauge of external static pressure.
  6. Electrical Requirements:
    - a. Fan powered terminal units shall be provided with single-point power connection & factory installed fused disconnect switch.
    - b. The terminal unit equipment wiring shall comply with the requirements of NFPA 70.
  7. Hot Water Heating Coil:
    - a. The hot water coil casing shall be constructed from a minimum 22 gauge, 0.032 inch galvanized steel, factory-installed on the terminal discharge with slip-and drive attachment for downstream ductwork.
      - 1) An optional gasketed and insulated access door shall be provided, located on bottom of unit.
      - 2) Coil handling shall be identical to unit handling.
    - b. The water coil fins shall be 0.0045 inch aluminum fins, mechanically-bonded to seamless 0.50 by 0.016 inch copper tubes.
      - 1) Fins shall be formed in a high heat transfer sine wave configuration.
      - 2) Standard coil shall be constructed with 10 fins-per-inch fin spacing.
      - 3) High capacity coil shall be constructed with 12 fins-per-inch fin spacing and larger casing to increase capacity.
    - c. All water coils shall be hydrostatically tested to a minimum 390 pounds per square inch, with a minimum burst pressure of 1800 pounds per square inch at ambient temperature. All water coils are rated for a maximum of 300 pounds per square inch working pressure at 200 degrees Fahrenheit.
    - d. The water coil shall be certified in accordance with AHRI 410 and units shall bear an AHRI 410 label.
  8. Plenum Return Filter:
    - a. The plenum return shall be supplied with fiberglass filters.
    - b. When tested in accordance with ASHRAE 52.2, the filter shall have a Minimum Efficiency Reporting Value of:

- 1) MERV 8 filter, supplied complete with a filter boot to decrease filter face velocity and pressure drop.

F. Controls

1. The terminal unit controller shall be a dedicated, microprocessor-based, pressure independent VAV controller complete with electronic flow transducer. The controller shall be capable of stand-alone operation and have the ability to network with a building automation system, personal computer or portable operator interface device.
2. The electric actuator shall be 24 VAC bi-directional, direct coupled to the damper shaft. The actuator must be capable of operating in the stalled position without overheating or mechanical damage.
3. The terminal unit manufacturer shall provide a flow cross or two (2) pipe sensor suitable for interfacing with a differential pressure sensor.
4. The temperature control contractor shall furnish the terminal equipment controller, flow transducer, and electric actuator for installation on each terminal unit by the terminal unit manufacturer. The cost of factory mounting, wiring, enclosure to meet local code and any factory testing and programming of the terminal equipment controller shall be included by the terminal manufacturer.
5. All components shall be calibrated and pretested to ensure a fully functional unit.
6. The zone sensor shall be furnished by the Temperature Control Contractor and shall include temperature setpoint adjustment and access for connection of a hand-held operator terminal or portable computer.
7. The DDC control package shall be calibrated and factory set for the maximum and minimum flow rates as scheduled on the drawings.
8. The air terminal unit shall be designed, installed and field adjusted, if necessary, to maintain controlled pressure independent air flow.
9. All control components shall be mounted inside a protective metal enclosure.

G. Installation

1. Install the terminal units in accordance with the manufacturer's instructions.
2. Install the inlets of the air terminal units with the air flow sensors a minimum of three duct diameters from elbows, transitions, and duct takeoffs.
3. See drawings for the size(s) and duct location(s) of the air terminal units.
4. Provide ceiling access doors or locate units above easily removable ceiling components.
5. Support the terminal units individually from the structure in accordance with manufacturer's recommendations.
6. Embed anchors in concrete in accordance with ASTM E488/E488M.
7. Do not support the terminal units from the ductwork.
8. Connect the terminals to the ductwork in accordance with Section 23 31 00.
9. Install heating coils in accordance with Section 23 82 00.
10. Verify that electric power is available and of the correct characteristics.

H. Adjusting

1. Ensure the damper operator attached to the assembly allows full modulation of flow range from 100 percent of design flow to zero.

I. Provide and install options and accessories as noted on plans.

## 2.12 DUCT MOUNTED HOT WATER COILS

A. SUBMITTALS

1. Shop Drawings: Indicate coil fin height & length AND overall height, length and depth, connection sizes & location, flange mounting dimensions, and direction of airflow.
2. Product Data.
  - a. Certification - Acceptable coils are to be certified in accordance with ARI Standard 410 and bear the ARI label. Coils exceeding the scope of the manufacturer's certification and/or the range of ARI's standard rating conditions will be considered provided the manufacturer is a current member of the ARI Air-Cooling and Air-Heating Coils certification programs and that the coils have been rated in accordance with ARI Standard 410. Manufacturer must be ISO 9002 certified.

- b. Identify fin, tube & casing material type and thickness.
  - c. Show coil weight (shipping & operating).
  - d. State air and water flow amounts with its associated pressure drops.
  - e. Indicate entering & leaving air and water temperatures.
- B. QUALIFICATIONS
  - 1. Manufacturer: Company specializing in manufacturing water cooling and heating coils specified in this section must show a minimum five years experience and issues complete catalog data.
- C. DELIVERY, STORAGE, AND HANDLING
  - 1. Deliver, store, protect and handle products to site.
  - 2. Accept products on site on factory-installed shipping skids. Inspect for damage.
  - 3. Store in a clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage.
- D. GENERAL DESCRIPTION
  - 1. Furnish as shown on plans and as described in the specification, Daikin Applied Water Heating Coils.
  - 2. Coils to have extended surface, staggered tube, and plate fin design.
- E. HEADERS
  - 1. Made of seamless copper tubing to assure compatibility with primary surface.
  - 2. Headers to have intruded tube holes to provide maximum brazing surface for tube to header joint, strength, and inherent flexibility. Header diameter should vary with fluid flow requirements.
  - 3. Vent and drain plugs shall be provided on the coil header. For certain replacement air handler (Vision/Skyline & some LSL models) coils the plugs will be provided on the coil connections. For replacement air handler (LSL/LHD) heating coils that are uncased, vent and drain plugs will not be provided.
- F. CONNECTIONS
  - 1. Coil connection should be compatible with the piping to the coil to minimize chance of "galvanic action/electrolysis".
  - 2. Connections shall be a diameter adequate for specified gpm flow.
    - a. The connections are located to permit right hand mounting of the coil and assure equal pressure through all the circuits.
  - 3. Connection and material type.
    - a. Connection material to be carbon steel pipe. Connection type to be threaded.
  - 4. Coils are circuited to provide maximum mean effective temperature difference for heat transfer rates.
  - 5. Coils, greater than 2 rows, must be arranged for counter flow.
- G. TESTING AND PRESSURE RATINGS
  - 1. Completed coils are tested at a minimum of 315 PSIG air pressure while submerged in warm water.
  - 2. Hydronic tests alone are not acceptable.
  - 3. Standard coil construction is rated for 250 PSIG working pressure at 300 degrees F.
- H. CAPACITY
  - 1. Coil capacity shall be as outline on the project schedule and confirmed with computer generated output.
  - 2. Application.
    - a. Heating.
  - 3. Fluid Type.
    - a. Ethylene Glycol.
- I. PRIMARY SURFACE
  - 1. Tubes to be 5/8" O.D., staggered in direction of airflow, and must be on 1 1/2" tube centers.

2. Wall thickness to be .020" nominal copper and water pressure drop of coil selection adjusted to wall thickness specified.
  3. Tubes to be mechanically expanded in to fin collars to provide a continuous primary to secondary compression bond over entire coil length, assuring maximum heat transfer.
  4. Coil Tube Type.
    - a. Standard smooth bore.
    - b. Standard smooth bore with internal brass spring turbospirals.
- J. SECONDARY SURFACE
1. Plate style fins shall be corrugated for high capacity and structural strength.
    - a. Fin thickness shall be .0075" aluminum.
  2. The fins to have collars to determine fin spacing per inch and support the heat transfer bond to primary surface. Tubing should not be visible between the fins.
    - a. Fin Style to be a New Ripple fin type.
- K. COIL TYPE & SERPENTINE
1. 5WH - Half Serpentine.
  2. Coils available from 12" to 54" fin height on 1.5" tube centers and on 3" increments.
  3. All water cooling and heating coils with standard .020" nominal copper tubing available from 12" to 216" fin length in two decimal point increments. For other tube material types the maximum tube length is 180".
- L. CASINGS
1. Casing Style
    - a. Contractor Coil with flanged casing.
  2. Casing Material.
    - a. Galvanized Steel.
- M. PROTECTIVE COATINGS
1. None, specified coil and casing material only.
- N. PACKAGING
1. Coil(s) to be fully crated in a wood enclosure with protective cardboard covering the finned area.
- O. INSTALLATION
1. Install in accordance with manufacturer's recommendations.
- P. Provide and install accessories as scheduled on plans.

## **2.13 STATIONARY LOUVER**

- A. Furnish and install louver as hereinafter specified where shown on plans or as described in schedules. Louvers shall be stationary drainable type with drain gutters in each blade and downspouts in jambs and mullions. Louvers shall have a minimum of 57% free area based on a 48" x 48" high size. Stationary drainable blades shall be contained within a 4" frame. Louver components shall be factory assembled by the louver manufacturer. Louver sizes too large for shipping shall be built up by the contractor from factory assembled louver sections. Blades shall be 0.080 inch thick extruded aluminum at 37-1/2 degree angle on approximately 5" centers. A birdscreen shall be contained within a removable frame.
- B. Provide & install access door in ductwork to access birdscreen. Access door in chase by GC, coordinate exact location and size.
- C. Provide & install accessories as scheduled on the plans.

## **2.14 SMOKE DAMPERS**

- A. General Requirements: Label according to UL 555S by an NRTL.
- B. Smoke Detector: Integral, factory wired for single-point connection.
- C. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.
- D. Vertical blades are available for special applications.

- E. Blades: Roll-formed, horizontal, interlocking, 0.034-inch-thick, galvanized sheet steel.
- F. Leakage: Class I.
- G. Rated pressure and velocity to exceed design airflow conditions.
- H. Mounting Sleeve: Factory-installed, 0.039-inch-thick, galvanized sheet steel; length to suit wall or floor application.
- I. Damper Motors: two-position action.
- J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 15058 "Common Motor Requirements for HVAC Equipment."
  - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
  - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 15900 "HVAC Instrumentation and Controls."
  - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
  - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
  - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
  - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- K. Smoke dampers shall be by the same manufacturer and shall be smoke tight, and shall be complete with 120V electric actuator. Actuator shall be wired by Division 26.

## **2.15 MOTORIZED CONTROL DAMPERS**

- A. Furnish and install, as shown on plans, Ruskin CD-50 low leakage damper OR equal.
- B. Outside air damper to be normally closed, return air damper to be normally open.
- C. Dampers to be 24V, provided & ducted by VC, wired by TC.
- D. Damper blade shall be of not less than 16 gauge galvanized steel formed for strength and high velocity performance with closed-cell neoprene edging. Damper blades shall not exceed 8 inches in width. Blades shall be secured to ½ inch diameter zinc plated axles by zinc plated bolts and nuts. All blade bearings shall be nylon. Blade side edges shall seal off against spring stainless steel seals. Teflon coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and ensure smooth operation. All blade linkage hardware shall be constructed of corrosion resistant, zinc plated steel and brass. Dampers shall be suitable for operation within the following temperature limits, -40 degrees to 200 degrees F. and have a maximum leakage of 6 cfm per square foot at 4" water gauge.
- E. Provide & install accessories as scheduled on the plans, coordinate exact damper and installation with TC.

## **2.16 REGISTERS, GRILLES, AND DIFFUSERS**

- A. Furnish and install registers, grilles, and diffusers where shown on the Drawings. Type, size, and performance shall be as tabulated in the schedule and on the drawings. Provide & install accessories as scheduled on the plans.
- B. Provide and install options and accessories as described in schedule.

## **2.17 THROWAWAY FILTERS**

- A. Provide one additional set of throwaway filters for the entire system. Furnish and install throwaway type filters for air handling systems and return grilles, 1 or 2-inch thick disposable type, ASHRAE 52.1, U.L. Class 2, 30% Efficient Merv8, filters as manufactured by Flanders Airpure, American Air Filter, Farr, Cambridge, or equal where shown on the Drawings.
- B. Provide entire system with one additional set of disposable filters for the owner's use.

## **2.18 AUTOMATIC TEMPERATURE CONTROL**

- A. Install the automatic temperature control dampers, air flow monitoring devices, openings for air flow switches, alarms and control devices as provided by the Automatic Temperature Control Contractor. These dampers and devices shall be installed under the direct supervision of the Section 23 0900, CONTROLS & CONTROL SEQUENCES Temperature Control Contractor and in strict accordance with the manufacturer's recommendations.

## **2.19 SPARE PARTS**

- A. Provide all makeup air units, fan powered VAV's, and fan coil with one additional set of disposable filters.

**END OF SECTION 23 7000**

DIVISION 26-27-28 - ELECTRICAL

TABLE OF CONTENTS

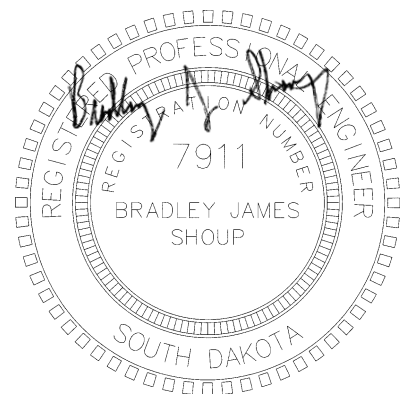
<u>SECTION</u>	<u>TITLE</u>	<u>NO. OF PAGES</u>
260100	COMMON ELECTRICAL REQUIREMENTS	8
260500	BASIC ELECTRICAL MATERIALS AND METHODS	9
260600	GROUNDING AND BONDING	6
261200	CONDUCTORS AND CABLES	5
261300	RACEWAYS AND BOXES	9
261400	WIRING DEVICES	5
261450	LIGHTING CONTROL DEVICES	4
262890	SURGE PROTECTION DEVICES	5
264100	ENCLOSED SWITCHES	4
264200	ENCLOSED CONTROLLERS	5
264420	PANELBOARDS	6
264610	DRY-TYPE TRANSFORMERS	4
264910	FUSES	3
265110	INTERIOR LIGHTING	5
277400	COMMUNICATION & DATA-PROCESSING EQUIPMENT	16
287210	FIRE ALARM	11

PROJECT: DIESEL ADDITION & REMODEL  
LAKE AREA TECHNICAL COLLEGE  
WATERTOWN, SOUTH DAKOTA

ACEI PROJECT NO.: 121066

DATE: November 4, 2021

Project Manual sections prepared by or under the supervision  
of Bradley Shoup, Reg. No. 7911, include all sections of  
Divisions 26, 27, 28.





THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 260100 – COMMON ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. In certain instances where the terms of this Division of the Specifications conflict with the terms of the General Conditions, or Special Conditions, this Division of the Specifications shall govern.
- B. Note that the complete electrical installation for this project falls under three specification divisions: Division 26, Division 27, and Division 28.
- C. The project shall be bid as one complete package with the final electrical construction bid containing all costs for Divisions 26, 27, and 28.
- D. The general requirements shown here in this Division 26 section shall also apply to Divisions 27 and 28.
- E. Where M.C. or Mechanical Contractor is referenced in Division 26, 27, or 28 specifications or on the electrical drawings, it refers to the general trade. Coordinate in field with the proper Fire Suppression, Plumbing, or HVAC Contractor based on the information in the specification or note.

#### 1.2 SUMMARY

- A. This Section shall include everything in Divisions 26, 27, and 28 of the Specifications and everything indicated on the Drawings that are complementary to these Divisions of the Specifications. Refer to the Index of Drawings to determine what Drawings apply directly to this section.
- B. Where “Contractor” is referred to in this Division of the Specifications it shall mean Contractor and/or Sub-Contractors responsible for all or any part of the electrical installation specified in Divisions 26, 27, and 28 and/or as shown on the Contract Drawings.
- C. Where the specifications in subsequent Sections of Divisions 26, 27, or 28 conflict with requirements of this Section, the specifications in the subsequent Sections shall govern.
- D. The contractor shall provide all items, articles, materials, operations or methods listed, mentioned or scheduled on the Drawings and/or herein specified, including all labor, materials, equipment, accessories, wiring, and incidents necessary to be installed in accordance with manufacturer’s recommendations except as otherwise approved.

#### 1.3 INTENT OF PLANS AND SPECIFICATIONS

- A. The intent of the plans and specifications are for the complete installation of the system described so that at the conclusion of the construction, the systems will be turned over to the owner complete and ready for safe and efficient operation. The plans and specifications cannot

deal individually with the many incidental items which may be required by the nature of the systems. The contractor shall be obliged to furnish and install all such items normally included on systems of this type, which while not mentioned directly in the drawings and specifications are obviously essential to the installation and operation of the system and which are normally furnished on quality installations of this type.

- B. The contractor shall make a thorough inspection of the conditions and be familiar with all conditions affecting the extent and cost of this work. Claims for extra payments as a result to examine the conditions will not be allowed.

#### 1.4 PERMITS AND SERVICE CHARGES

- A. All permits and service charges necessary for execution of the work under this Contract shall be obtained by and be paid for by the Contractor. It shall be the responsibility of the Contractor to determine the permit requirements of the local authorities and utility companies and the cost of required permits, service charges, tap fees and development fees shall be included in the Contractor's bid.
- B. All work shall be executed in accordance with all local, state, and national rules, regulations, codes, etc., which are applicable and shall be subject to inspection by the proper authorities.

#### 1.5 CODES AND STANDARDS

- A. All work performed and all equipment furnished under this Division of the Contract shall be manufactured and installed in strict accordance with all applicable codes and standards, including the applicable provisions of the following codes and standards.
  - 1. Local and State Codes, Standards, and Regulations.
  - 2. NFPA 70, National Electrical Code, Current Addition.
  - 3. National Board of Fire Underwriters (NBFU).
  - 4. National Electrical Manufacturers Association (NEMA).
  - 5. Underwriters Laboratories (UL).
  - 6. Electrical Testing Laboratory (ETL).
  - 7. Illuminating Engineering Society (IES).
  - 8. American National Standards Institute (ANSI).
  - 9. National Fire Protection Association (NFPA).
  - 10. International Building Code (IBC).
  - 11. International Fire Code (IFC).
- B. Compliance:
  - 1. Where specific requirements of any code vary with the requirements of another code, the higher standard as determined by the Architect/Engineer shall govern the installation. Contractors shall familiarize themselves with local codes and regulations which affect their work in any way. Extra payment will not be allowed for changes required by local codes and regulations.
  - 2. All equipment manufactured in accordance with the provisions of the above codes and standards shall bear the label of the respective association bureau thereon.

#### 1.6 DRAWINGS AND MEASUREMENTS

- A. In general, the Drawings of the electrical systems and equipment are to scale. However, to determine exact locations of walls and partitions, the Contractor shall consult the architectural and/or structural drawings which are dimensioned. Drawings shall not take precedence over field measurements.
- B. Drawings of fixtures and devices, although shown on scale drawings, are diagrammatic only. They are intended to indicate size and/or capacity where stipulated, approximate location and/or direction, and approximate general arrangement of one phase of work to another, but not the exact detail or exact arrangement of construction. If it is found, before installation of any or all construction phases, that a more convenient, suitable or workable arrangement of any or all phases of the project would result by varying or altering the arrangement indicated on the Drawings, the Architect/Engineer may require the Contractor to change the location or arrangement of the work without additional cost to the Owner. Such rearrangement shall be in accordance with directions from the Architect/Engineer.
  - 1. Install light fixtures and wiring devices at heights specified in the Electrical Symbol Legend or as shown on the drawings. All measurements are to center unless noted otherwise. Device heights indicated on architectural elevations shall take precedence over symbol legend.
- C. Where discrepancies are discovered after certain portions or phases of the work have been installed, the Architect/Engineer reserves the right to require the Contractor to make changes in conduit, fixture or equipment locations or arrangements to avoid conflicts with work at no additional cost to the Owner.
- D. Because the Drawings are to a relatively small scale to show as large a portion as is practical, the fact that only certain features of the systems are indicated does not mean that other similar or different features or details will not be required. The Contractor shall furnish all incidental labor, material or equipment for the systems so that each system is a complete and operating one unless otherwise specifically stipulated in the detailed body of the specifications.
- E. The Contractor, Subcontractor's and their respective trades shall cooperate in laying out their work so it will fit properly into the space provided. Promptly report to the Architect/Engineer any delay or difficulties encountered in the installation of this work which might prevent prompt and proper installation, or make it unsuitable to connect with or receive the work of others. Failure to so report shall constitute an acceptance of the work of other trades as being fit and proper for the execution of this work.

#### 1.7 SUBSTITUTIONS AND PRODUCT OPTIONS

- A. The Contractor and equipment suppliers shall read and familiarize themselves with articles concerning substitution of materials, as indicated in the Instructions to Bidders. Material and equipment substitutions will be handled as follows:
- B. Materials or equipment specified by name of manufacturer, brand, trade name or catalog reference, shall be furnished under the contract unless changed by Addenda or a Contract modification. Where two (2) or more materials are named, the choice of these shall be optional with the Contractor.
- C. Material or equipment followed by the phrase "or equal" shall establish a standard of required function, dimension, appearance and quality to be met by any proposed substitute. No substitution will be considered unless written request for substitution has been submitted by the

bidder and has been received by the Architect/Engineer at least seven days prior to the date for receipt of bids. The Architect/Engineer's decision on a proposed substitute shall be final. If the Architect/Engineer considers any proposed substitution equal, such will be set forth in an Addendum. Bidders shall not rely upon substitutions made in any other manner.

- D. Whenever an item of material or equipment is identified on the drawings or specifications by reference to brand name or catalog number, it shall be understood that the reference is made for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality, or function may be considered.
- E. The listing of any manufacturer preceded by the phrase "or equal by" does not imply automatic approval. It is the sole responsibility of the Contractor to ensure that any price quotations received and submittals made are for products which meet or exceed the specifications included herein. The Contractor must judge that such items of substitution are of equal quality and character to the specified items and it is physically adaptable for installation within the allotted space with all required service clearances. The cost of any changes to other trades as a result of use of the substitution material or equipment must be borne by the Contractor submitting such material or equipment.
- F. Should the Contractor wish to use materials or equipment other than those specified or listed as equal by Addenda, he shall attach his proposed substitution along with full descriptive and technical data for the proposed item with the appropriate add or deduct to the Contract amount, should the substitution be accepted. Substitutions proposed by the Contractor will not be considered in the award of the Contract.
- G. After the award of the Contract, any request for a substitution must be made in writing by the Contractor (not the material supplier or subcontractor). Such request shall state the name of the product specified, the name of the product proposed for substitution, the reason for requesting the substitution, and any change to the Contract amount resulting from the substitution. No such substitution shall be made until an appropriate Contract modification has been issued and approved.

## 1.8 SUBMITTALS

### A. Schedule of Values:

- 1. The Contractor shall submit an itemized schedule of values for the various portions of the work, including separation of labor and materials for each item, to the Engineer before submission of the first Request for Payment. The schedule of values shall be divided so as to facilitate the Engineer's analysis of the various costs for the purpose of approval of the payment requests. The submittal shall meet the approval of the Engineer before any progress payment will be provided. The following are required categories for the cost breakdown.
  - a. Service and Distribution Equipment.
  - b. Lighting.
  - c. Wiring Devices.
  - d. Equipment Connections.
  - e. Basic Materials.
  - f. Special Systems.

### B. Shop Drawings:

- 1. Refer to the requirements of the General Conditions. Unless indicated otherwise in the General Conditions, submit to the Architect/Engineer one electronic copy of Shop

Drawings for each item of equipment to be installed under this contract. Furnish additional Shop Drawings as required for coordination with General Contractor and other Subcontractors. Furnish Shop Drawings as follows:

- a. For all major items of equipment or materials, regardless of whether the item is to be furnished as specified.
  - b. For all equipment, systems or devices where Shop Drawings are specifically called for.
  - c. For all minor items of equipment or materials where the Contractor proposes to deviate from the specified and/or scheduled manufacturer or material.
  - d. Shop drawings shall include manufacturer, catalog number, voltage and current characteristics, wire sizes, construction, and rough-in data of all materials to be used. Each product data sheet shall clearly indicate the proposed product.
  - e. Major components of Divisions 26, 27, and 28 shall be submitted at one time. All such literature shall be bound in amply sized three-ring binders with table of contents and tabbed sections separating and identifying the sections of the shop drawings. Tabbed sections shall correspond with Divisions 26, 27, and 28 specification sections.
2. The Contractor shall check all Shop Drawing submittals for compliance with Contract Documents, for size, capacity, arrangement, connection locations, materials, finish, color, electrical characteristics, accessories, and shall so note the Shop Drawings prior to submittal to the Architect/Engineer. Any deviation from the Drawings and Specifications shall be indicated.
    - a. Each shop drawing shall be certified as being checked and approved by the Contractor before submittal. Shop drawings not indicated as being approved by the Contractor will be returned without review.
  3. Shop Drawings will be reviewed by the Architect/Engineer, and copies of Shop Drawings will be returned to the Contractor. Shop Drawings shall be submitted sufficiently in advance of the construction schedule to allow time for checking Drawings, resubmittal and rechecking when necessary.
  4. Any equipment or material which is installed without authorization by properly processed Shop Drawings will be subject to removal by the Contractor and reinstallation as directed, without cost to the Owner. All cost for repair for damages as may be incurred to the structure as a result of the above correction shall be paid by this Contractor.
  5. Shop drawing material quantities will not be checked by the Architect/Engineer, and review of Shop Drawings by the Architect/Engineer shall not be construed to be verification of the material quantities and sizes shown on the Shop Drawings. Quantities, sizes, dimensions and locations shown on the Drawings and as specified shall determine material requirements.
  6. The Contractor shall maintain two (2) copies of approved shop drawings to be submitted with the Operating and Maintenance Manuals.

## 1.9 QUALITY ASSURANCE

- A. Materials and equipment shall be new and of the best quality, of the type best suited for the purpose intended, and be made by nationally recognized and substantially established manufacturers. The type and weight of material used for each purpose shall be as herein specified, and material shall conform to the requirements of the latest standard specifications of the "ASTM" for that particular material.
- B. All materials and equipment shall be listed, labeled, or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established.

1. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified, or otherwise determined to meet safety requirements of a nationally recognized testing laboratory.
  2. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- C. The installation work included in this specification shall be performed in a neat workmanlike manner by persons experienced and skilled in the Electrical trade. Only the best quality workmanship will be accepted. All exposed parts of the electrical wiring systems such as exposed conduits, flush plates, cabinet trims, fixtures, etc., shall be square and true with the building construction.

#### 1.10 COORDINATION OF WORK

- A. The Mechanical and Electrical Contractors and their Subcontractors shall have coordination meetings to facilitate the installation of equipment, ducts, pipes, electrical panels and equipment, and other miscellaneous equipment. The Mechanical Contractor and Electrical Contractor shall coordinate the location of all equipment during the coordination meetings to prevent interferences between equipment of different systems. Any conflicts that may be discovered during the coordination meetings shall be brought to the immediate attention of the Engineer.
- B. The Contractor shall order equipment and materials in a timely manner and shall be responsible for close correlation of the work with that of all other Contractors on this project so that it will not interfere with or delay the work of other Contractors. The Contractor shall confer and cooperate with all other Contractors on this project and shall arrange the work in proper relation to the work of others.

#### 1.11 RECORD DRAWINGS AND OPERATING AND MAINTENANCE MANUALS

- A. Record Drawings:
1. The Contractor shall keep a complete set of all electrical drawings in the jobsite office for purpose of showing the installation of electrical systems and equipment. This set of drawings shall be used for no other purpose. Where any materials equipment or system components are installed different from that shown on the Architect/Engineer's drawings, such differences shall be clearly and neatly shown on this set of drawings using ink or indelible pencil. At the completion of the project, the record set of drawings shall be turned over to the Architect/Engineer and shall become his property.
    - a. Incorporate all changes made by addendum, shop drawing review, change order, and field orders.
- B. Operating and Maintenance Manuals:
1. The Contractor shall furnish the Owner with two (2) sets of complete catalog data (approved shop drawings), manufacturer's literature and detailed manuals covering the operation and maintenance of all equipment specified under this Division.
    - a. Comply with Division 1 requirements.
    - b. The manual shall indicate the Contractor's name, address, and phone number and include a list of all Subcontractors, including company name, address, and telephone number.

- c. The manual shall include, but not be limited to, the following: Installation instructions; maintenance and overhaul instructions; procedures for start, operation, and shut down of equipment and systems; complete wiring and control diagrams; cleaning of lighting fixtures lenses and other equipment; safety precautions; diagrams and illustrations; manufacturers' name and catalog data; test procedures; name and address of authorized service organizations; and parts distributor for all material and equipment installed. Include all special warranty statements for all special warranties required by contract documents.
- d. The manual shall include a complete inventory list of all extra materials which are specified to be provided in the Contract.
- e. All such literature shall be bound in an amply sized three-ring binder with table of contents and tabbed sections separating and identifying the sections of the manual.
- 2. The Contractor shall supervise the initial operation of all equipment and instruct the Owner's designated operator or maintenance representative in such operation as to acquaint the operator thoroughly with the equipment.

C. Testing:

- 1. Work which is required to be placed within the construction or concealed shall be carefully tested and inspected before being permanently concealed.
- 2. The Contractor shall provide all testing instruments, equipment, and all materials, connections, labor, etc., required to perform tests.
- 3. Test all circuits, fixtures, equipment, and systems for proper operation and freedom from grounds, shorts, and open circuits before acceptance is requested.
- 4. Provide complete operational sequence checkout to verify all modes of operation both normal and alarm for each system. Test all control systems that interact with each other as a complete system to demonstrate that all interconnections and interactions are correct and that all interconnect wiring is functional.
- 5. Perform all tests required by local authorities, such as tests of life safety systems, in addition to tests specified herein. Perform tests required by other specification sections.
- 6. Tests shall be made in the presence of the Engineer and the Owner, and shall meet with their approval. The Contractor shall notify the Engineer at a time sufficiently prior to the performance of any test to allow time for the engineer to be present for the test.
- 7. The entire system shall be subject to a test at full operating and under normal usage conditions. This shall include voltage and current checks, resistance measurements, and equipment operation. Failure of any phase of system operation shall constitute failure of the system. Correct failures and retest system. Repeat until the system is operating to required specifications.
  - a. Submit dated "Electrical System Test Reports" indicating all tests performed and demonstrating conformance with the required system performance criteria in tabular form.
- 8. After testing the apparatus, the entire system shall be operated for one week under normal conditions.
- 9. The final testing shall be performed as soon as possible after the work is entirely completed.

## 1.12 FINAL INSPECTION

- A. Upon completion of the work, the Contractor shall notify the Architect and/or Engineer and make arrangements for a final inspection. The Contractor shall submit the operation and maintenance manuals prior to the final inspection; the Engineer will not schedule nor perform a final inspection without successful submittal of operating and maintenance manuals by the Contractor.



1. During the final inspection and subsequent follow-up final inspection, the Contractor and all major Sub-Contractors shall have the foreman of the project present.
- B. After the Engineer's final inspection is made, the Contractor will receive a list of items requiring adjustment, correction, replacement, or completion.
- C. The Contractor shall comply completely with all the listed requirements within thirty (30) days of receipt of the list. Should the Contractor fail to perform within this time limit, the Owner reserves the right to have the work completed by others and the cost deducted from the contract price.
- D. The Contractor shall notify the Architect and/or Engineer once all listed requirements are completed, that the Contractor is ready for a follow-up final inspection. The written notice shall contain explanations for those known items not completed and a schedule for completing them.
- E. The Architect and/or Engineer shall schedule a follow-up final inspection to confirm completion of all listed requirements. Repeated inspection trips required of the Engineer due to the Contractor's inability to complete the project satisfactorily will require the Contractor to reimburse the engineer for all incurred costs after the follow-up final inspection.

#### 1.13 GUARANTEE

- A. The Contractor shall assume responsibility for any defects which may develop in any part of his work caused by faulty workmanship, material or equipment, and agrees to replace, repair, or alter, at the Contractors expense, any such faulty workmanship, material, or equipment that has been brought to the Contractors attention during a period of one year from the date of the final certificate for payment. Acceptance of the work shall not waive this guarantee.
  1. Refer to Divisions 26, 27, and 28 Specifications for additional special equipment warranties.

END OF SECTION 260100

## SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. In certain instances where the terms of this Division of the Specifications conflict with the terms of the General Conditions, or Special Conditions, this Division of the Specifications shall govern.

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Supporting devices for electrical components.
  - 2. Electrical identification.
  - 3. Concrete equipment bases.
  - 4. Firestopping
  - 5. Cutting and patching for electrical construction.
  - 6. Touchup painting.

#### 1.3 SUBMITTALS

- A. Product Data: Include manufacturer product data sheets for underground warning tape and firestopping materials to be utilized on this project.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

#### 1.5 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
  - 1. Coordinate installation and connection of exterior underground utilities and services, including relocation of the existing CT cabinet.
  - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

## PART 2 - PRODUCTS

### 2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
  - 1. Channel Thickness: Selected to suit structural loading.
  - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers. Wire hangers shall not be utilized for supporting raceway or boxes (except for supporting raceways installed within steel stud walls where raceways are supported from the studs).
- E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- F. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- G. Expansion Anchors: Carbon-steel wedge or sleeve type.
- H. Toggle Bolts: All-steel springhead type.

## 2.2 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Colored Adhesive Marking Tape for Raceways: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick).
- C. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
  - 1. Not less than 6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick).
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend that indicates type of underground line.
- D. Tape Markers for Wire and Cables: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- E. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch (1.6-mm) minimum thickness for signs up to 20 sq. in. (129 sq. cm) and 1/8-inch (3.2-mm) minimum thickness for larger sizes. Engraved legend in black letters on white background.
- G. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- H. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm), galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6-mm) grommets in corners for mounting.
- I. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

## 2.3 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: 3000-psi, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

## 2.4 FIRESTOPPING

- A. Conduit, cable penetrations, and any other electrical equipment penetrations of fire rated construction, equipment rooms, and/or where designated on the Drawings shall be sealed with a fire retardant sealant similar to:

1. Specified Technologies, Inc. (STI) SpecSeal Series SSS Intumescent Sealant.
  2. STI SpecSeal Series LCI Intumescent Sealant.
  3. STI SpecSeal Series SST Firestop Putty.
  4. STI SpecSeal Series SSB Firestop Pillows.
  5. STI Pensil 200 Silicone Foam.
  6. STI EZ-PATH Fire Rated Pathway or Hilti Speed Sleeve.
- B. Fire sealants shall be Specified Technologies, Inc., 3M Fire Protection Products, A/D Fire Protection Systems, Inc., Hilti Inc., Nelson Firestop Products, or equal.
1. Firestopping materials shall be low VOC.
- C. Obtain through-penetration firestop systems from a single manufacturer with experienced installers having the necessary experience, staff, and training to install manufacturer's products per project requirements.

## 2.5 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## PART 3 - EXECUTION

### 3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. The installation shall be in accordance with the latest requirements of the NEC, State, and Local Codes, ordinances and regulations of any other governing body having jurisdiction
- B. All equipment shall be installed in a neat and workmanlike manner and to the satisfaction of the Project Engineer.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- D. Equipment Rooms: Line walls where electrical equipment is to be mounted with ¾" plywood backboards. Paint backboards with two coats of low VOC gray fire retardant paint.
1. Where equipment is installed in rooms being used as return air plenums, electrical equipment shall be mounted to Hoover Treated Wood Products Pyro-Guard backboards.
- E. Mount panelboards, contactors, and other electrical equipment on backboards, unless otherwise indicated.
- F. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- G. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- H. Right of Way: Give to raceways and piping systems installed at a required slope.

### 3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

### 3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
  - 1. Wire hangers are not an acceptable support component for supporting raceways and boxes (except for supporting raceways installed within steel stud walls where raceways are supported from the studs).
  - 2. Raceways and boxes shall be rigidly fastened and supported. Aircraft cable hanging systems (gripple hangers) are not acceptable.
  - 3. Nothing shall rest on, or depend for support on, suspended ceilings (tiles, lath, plaster, as well as splines, runners, bars, and the like in the plane of the ceiling).
  - 4. Support raceways at intervals no greater than ten feet and with one support within three feet of each coupling, box, fitting, or outlet box. Provide one support within three feet of each elbow or bend.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.

- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts.
  - 5. Steel: Welded threaded studs or spring-tension clamps on steel.
    - a. Field Welding: Comply with AWS D1.1.
  - 6. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
  - 7. Light Steel: Sheet-metal screws.
  - 8. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### 3.4 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying. Self adhesive identification products are not approved for electrical equipment enclosure labels.
- D. Identify raceways and cables with color banding as follows:
  - 1. Bands: Pretension, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.

2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (8-m) maximum intervals in congested areas.
  3. Colors: As follows:
    - a. Fire Alarm System: Red.
    - b. Security System: Blue.
    - c. Telecommunication Systems: Green.
- E. Tag and label circuits. Identify source and circuit numbers in each cabinet, pull and junction box, and receptacle outlet box. Color-coding may be used for voltage and phase identification. Neatly mark junction box covers (outside of box where concealed in building finishes or in unfinished spaces, inside of box in finished public spaces) with voltage, source and circuit numbers with permanent black marker.
1. Feeder and Power Circuit Identification: Use plasticized card stock for cables, feeders, and power circuits in pull boxes and electrical rooms.
    - a. Legend: 1/4" steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
    - b. Fasten tags with nylon cable ties, fasten bands using integral ears.
  2. Apply identification to conductors as follows:
    - a. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
    - b. Multiple Control or Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking type.
- F. Equipment Identification: Apply equipment identification labels of engraved plastic laminate on each major piece of equipment. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Provide labels for the following types of equipment.
1. Distribution panels, panelboards, and electrical enclosures.
  2. Access doors and panels for concealed electrical items.
  3. Enclosed controllers, indicate which motor or piece of equipment the unit is serving.
  4. Enclosed switches, indicate which motor or piece of equipment the unit is serving.
  5. Service Equipment: Service equipment in other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field marking(s) shall include the date the fault current calculation was performed.
  6. Lighting control panels and contactors.
  7. Transformers.
- G. Install continuous underground warning tape during trench backfilling, for exterior underground power, control, signal, and communication lines, locate marker directly above power and communication lines. Locate approximately 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm), overall, use a single line marker.
- H. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
1. Phase A: Black.
  2. Phase B: Red.
  3. Phase C: Blue.



- I. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
  - 1. Phase A: Brown.
  - 2. Phase B: Orange.
  - 3. Phase C: Yellow.
- J. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- K. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

### 3.5 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 2 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."
- B. The Electrical Contractor shall size and provide the concrete and installation associated with the following items as called out elsewhere in the plans and specifications:
  - 1. CT Cabinet Pad.
  - 2. Dry-Type Transformer Pads.
- C. Provide "house keeping pads" for all floor mounted electrical components, including transformers, switchboards, distribution boards, and motor controls centers. Pads shall be a minimum of 4" thick and comply with parts 2 and 3 of this specification section.

### 3.6 FIRESTOPPING

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

### 3.7 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.8 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Supporting devices for electrical components.
2. Electrical identification.
3. Electricity-metering components.
4. Concrete bases.
5. Firestopping materials.
6. Cutting and patching for electrical construction.
7. Touchup painting.

### 3.9 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### 3.10 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260500

THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 260600 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

#### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - 1. Comply with UL 467.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Grounding Conductors, Cables, Connectors, and Rods:
    - a. Chance/Hubbell.
    - b. Copperweld Corp.
    - c. Erico Inc.; Electrical Products Group.
    - d. ILSCO.
    - e. O-Z/Gedney Co.; a business of the EGS Electrical Group.
    - f. Raco, Inc.; Division of Hubbell.
    - g. Superior Grounding Systems, Inc.
    - h. Thomas & Betts, Electrical.

#### 2.2 GROUNDING CONDUCTORS

- A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."
- B. Equipment Grounding Conductors: Insulated with green-colored insulation.

- C. Grounding Electrode Conductors: Stranded copper cable, #4 AWG minimum.
- D. Underground Conductors: Bare, tinned, stranded copper, unless otherwise indicated.
- E. 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.
- F. Copper Bonding Conductors: As follows:
  - 1. Bonding Cable: Minimum size of 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
  - 2. Bonding Conductor: Minimum size of No. 6AWG, stranded copper conductor.
  - 3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; minimum size of 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
- G. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

## 2.3 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 per manufacturer's written instructions.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel.
  - 1. Size: 5/8 by 120 inches.

# PART 3 - EXECUTION

## 3.1 APPLICATION

- A. Multiple Disconnecting Means Enclosures: Comply with NEC article 250.64(D).
- 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. In raceways, use insulated equipment grounding conductors.
- D. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

- E. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- F. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
- G. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

### 3.2 EQUIPMENT GROUNDING CONDUCTORS

- 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. Install equipment grounding conductors in all feeders and branch circuits.
  - 1. Bond the grounding conductor to each pullbox, junction box, outlet box, cabinets, and other enclosure through which the ground conductor passes.
- C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
- D. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
  - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

### 3.3 INSTALLATION

- A. 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. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
  - 2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
- B. 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.
- C. 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 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.

- D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes 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.
- E. Water Meter and Filter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filters or other serviceable equipment. Connect to pipe with grounding clamp connectors.
- F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.
- H. Bond metal water piping systems in accordance with NEC Article 250.104.
- I. Bond the grounding electrode system to the structural steel of building, if any, using exothermic weld. Coordinate work with the General Contractor.
- J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NEC Article 250, using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within the base of the foundation. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete. Coordinate work with the General Contractor.
- K. See grounding detail on the drawings.

### 3.4 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. Remove all point from points of contact prior to making connections.
  - 3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: 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: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- 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. 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 and UL 486B.
- F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. 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.
- G. 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.

### 3.5 FIELD QUALITY CONTROL

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  - 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. 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.
  - 3. Measure ground resistance from the system neutral connection at the service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
  - 4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

### 3.6 GRADING AND PLANTING

- A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 32 Section "Turf and Grasses." Maintain restored surfaces. Restore disturbed paving as indicated.



END OF SECTION 260600

## SECTION 261200 - CONDUCTORS AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

#### 1.3 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.

- 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

- B. Comply with NFPA 70.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Wires and Cables:

- a. American Insulated Wire Corp.; Leviton Manufacturing Co.
    - b. BICC Brand-Rex Company.

- c. Kingwire, Inc.
- d. Southwire Company.
- e. Encore Wire.

2. Connectors for Wires and Cables:

- a. AMP Incorporated.
- b. General Signal; O-Z/Gedney Unit.
- c. Square D Co.; Anderson.
- d. 3M Company; Electrical Products Division.
- e. Arlington Fittings.
- f. Bridgeport Fittings.

## 2.2 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
- B. Thermoplastic Insulation Material: Comply with UL 83 and NEMA WC-70 (ICEA S-95-658).
- C. Cross-Linked Polyethylene Insulation Material: Comply with UL 44 and NEMA WC-70 (ICEA S-95-658).
- D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC-70 (ICEA S-95-658).
- E. Conductor Material: Copper, except feeders larger than 80 amps may be aluminum AA-8000.
  - 1. Verify with mechanical contractor if aluminum conductors can be utilized for connections to mechanical equipment. Utilize copper conductors where required.
- F. Stranding: Solid conductor for No. 12 AWG and smaller; stranded conductor for No. 8 AWG and larger. No. 10 AWG to be either solid or stranded (contractor's option).

## 2.3 CONNECTORS AND SPLICES

- A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.
- B. All branch circuit wiring connections shall be made using wire nut connectors which provide direct wire to wire contact. Connectors which utilize insulation displacement, intermediate metal or spring compression connection are not acceptable.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 WIRE AND INSULATION APPLICATIONS

- A. Service Entrance: Type XHHW-2 or THWN-2, in raceway.
- B. Feeders: Type THHN/THWN-2, in raceway.
- C. Branch Circuits: Type THHN/THWN-2, in raceway.
- D. Fire Alarm Circuits: Power-limited, fire-protective, signaling circuit cable, in raceway (allowed "free-air" where concealed above accessible lay-in tile ceilings).
- E. Fire Alarm Circuits: Type THHN/THWN-2, in raceway.
- F. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.
- G. Class 2 Control Circuits: Power-limited cable, concealed in building finishes or in raceway where installed exposed in finished public spaces.
- H. Class 2 Control Circuits: Type THHN/THWN-2, in raceway.

### 3.3 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Remove existing wires from raceway before pulling in new wires and cables.
- C. Unless otherwise noted or shown on the drawings, a maximum of three circuits (three phase conductors, neutrals, and ground) shall be allowed in a single home run raceway.
- D. Multiwire Branch Circuits: Sharing of neutrals is not allowed, provided dedicated neutral for each branch circuit.
- E. Wire size on 120 volt, 20 ampere branch circuit home run conductors over 75 feet in length (from the closest wiring device at the home run designation to the associated panelboard shown on the electrical drawing sheets), shall be increased to No. 10 AWG (minimum) to limit excessive voltage drop.
- F. Pull Conductors: 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.
- G. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- H. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- I. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."
- J. Seal around cables penetrating fire-rated elements according to 260500 and Division 7 Section "Firestopping."

- K. Identify wires and cables according to Division 26 Section "Basic Electrical Materials and Methods."

### 3.4 CONNECTIONS

- A. Conductor Splices: Keep to minimum.
- B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Wiring at Outlets: Install pigtail conductor at each outlet, with at least 8 inches of slack. Where multiple sets of conductors enter a box, provide 8" pigtails to devices and make connections such that the continuity of the branch circuit conductors is not dependent upon device connections and the continuing load is not routed through the device. All unused device terminal screws shall be turned completely in, provide two full wraps of electrical tape around all device terminals. On 20 amp circuits where #10 AWG conductors are required for home runs, provide #12 AWG solid pigtails for connection to device.
- E. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- F. 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.

### 3.5 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection test stated in NETA ATS, Section 7.3.
- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

### 3.6 STARTUP SERVICE

- A. Verify that heat trace systems are installed and connected according to the Contract Documents.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- C. Complete installation and startup checks according to manufacturer's written instructions.

### 3.7 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain heat trace systems.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 261200

THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 261300 - RACEWAYS AND BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

#### 1.3 SUBMITTALS

- A. Product Data: For floor boxes.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

#### 1.5 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

#### 2.1 METAL CONDUIT AND TUBING

- A. Manufacturers: Subject to compliance with requirements, provide products one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alfex Inc.
  - 3. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 4. Electri-Flex Co.
  - 5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
  - 6. LTV Steel Tubular Products Company.
  - 7. Manhattan/CDT/Cole-Flex.



8. O-Z Gedney; Unit of General Signal.
9. Shamrock Steel.
10. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. PVC Coated Rigid Steel Conduit: NEMA RN 1.

E. EMT and Fittings: ANSI C80.3.

1. Fittings: Steel, set-screw or compression type with insulated bushings for protection of conductors. Diecast fittings are not approved.

F. FMC: Zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket.

## 2.2 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. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; Division of Hubbell, Inc.
12. Spiralduct, Inc./AFC Cable Systems, Inc.
13. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

D. LFNC: UL 1660.

## 2.3 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hoffman.
2. Square D.

3. Mono Systems, Inc.

- B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA [1] [3R].
- 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.

## 2.4 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. Mono-Systems, Inc.
    - d. Walker Systems, Inc.; Wiremold Company (The).
    - e. Wiremold Company (The); Electrical Sales Division.
- B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. Emerson/General Signal; Appleton Electric Company.
  - 3. Erickson Electrical Equipment Co.
  - 4. Hoffman.
  - 5. Hubbell, Inc.; Killark Electric Manufacturing Co.
  - 6. O-Z/Gedney; Unit of General Signal.
  - 7. RACO; Division of Hubbell, Inc.
  - 8. Robroy Industries, Inc.; Enclosure Division.
  - 9. Scott Fetzer Co.; Adalet-PLM Division.
  - 10. Spring City Electrical Manufacturing Co.
  - 11. Thomas & Betts Corporation.
  - 12. Walker Systems, Inc.; Wiremold Company (The).
  - 13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

- B. Outlet boxes shall be galvanized steel standard electrical type with knockout openings as required.
- C. Outlet boxes shall be at least 1-1/2" deep, single or gang style type of sized to accommodate devices noted. Outlet boxes in masonry walls may be special masonry type. Outlet boxes on exposed conduit runs in unfinished areas and equipment rooms shall be 4" square or multi-gang boxes with matching raised covers. Outlet boxes on exposed conduit runs in finished areas or where indicated, shall be cast FS type.
  - 1. Outlet boxes for communications outlets shall be a minimum of 2-1/8" deep.
- D. Exterior outlet boxes shall be cast aluminum type with weatherproof cover and gasket. Outlet boxes for receptacle devices shall be provided with grounding lead lug or screw.
- E. Outlet boxes installed in plaster, plasterboard, acoustic tile, or paneled surfaces shall be provided with plaster rings, except 4" octagonal ceiling boxes. Outlet boxes installed in masonry, tile, or concrete surfaces shall be provided with square corner type extension rings where special masonry boxes are not used.
- F. Outlet boxes noted as WP (weatherproof) shall be a flush or surface (as noted) FS type box with at least 4 machine screw connections for a gasketed device or cover.
- G. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- H. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- I. Floor Boxes (Two Devices): Floor boxes installed in tile or carpet floors shall be equal to Steel City 664 Series. Concealed service type, 2-compartment, steel (cast iron where in contact with earth) construction with solid aluminum #664-CST-SW-ALM hinged floor plate and retractable exit port for power cords and communications cables. Provide internal device mounting panels compatible with devices being installed. Provide wiring and communications devices as shown on the floor plans and specified.
  - 1. Coordinate floor box types and covers in commercial kitchens with the food service equipment supplier as required for the receptacles to accommodate plug and cord associated with kitchen equipment.
- J. Floor Boxes (Up to Four Devices): Floor boxes installed in tile or carpet floors shall be equal to Steel City 665 Series. Concealed service type, 4-compartment, steel (cast iron where in contact with earth) construction with solid aluminum #665-CST-SW-ALM hinged floor plate and retractable exit port for power cords and communications cables. Provide internal device mounting panels compatible with devices being installed. Provide wiring and communications devices as shown on the floor plans and specified.
  - 1. Coordinate floor box types and covers in commercial kitchens with the food service equipment supplier as required for the receptacles to accommodate plug and cord associated with kitchen equipment.
- K. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- L. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- M. Provide wall plates for all unused outlet and device boxes. Wall plates shall comply with section 261400.
- N. 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.
  2. Provide backplate and grounding as required by the authority having jurisdiction for installation of indicated equipment.
- O. 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.

## 2.6 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard color paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. ENT – Electrical Non-metallic Tubing is not acceptable for use anywhere on this project.
- B. Outdoors:
1. Exposed: Rigid steel or IMC.
  2. Concealed: Rigid steel or IMC.
  3. Underground, Single Run: RNC, see installation for additional requirements.
  4. Underground, Grouped: RNC, see installation for additional requirements.
  5. Underslab: RNC, see installation for additional requirements.
  6. Embedded in slab: Rigid steel.
  7. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  8. Boxes and Enclosures: NEMA 250, Type 3R.
- C. Indoors:
1. Exposed: EMT.
  2. Concealed: EMT.
  3. Underslab: RNC, see installation for additional requirements.
  4. Embedded in slab: Rigid steel.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
  6. Damp or Wet Locations: EMT with compression fittings.
  7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
    - a. Damp or Wet Locations: NEMA 250, Type 4, nonmetallic.
- D. Minimum Raceway Size: ½-inch trade size (DN16), except home runs from the closest wiring device or light fixture at the home run designation to the associated panelboard shown on the electrical drawing sheets shall be ¾-inch (minimum) trade size (DN21).

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings with insulated bushings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

### 3.2 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated and in accordance to manufacturer's written instruction.

1. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
2. Install raceways level and square and at proper elevations. Provide adequate headroom.
3. Complete raceway installation before starting conductor installation.
4. Support raceways as specified in Division 26 Section "Basic Electrical Materials and Methods."
5. Install temporary closures to prevent foreign matter from entering raceways.
6. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab. Install a metal sleeve or concrete curb to provide a 4 inch high watertight barrier.
7. 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.
8. Metal-corrugated sheet roof decking: Install and support so that nearest outside surface of the raceway or box is not less than 1.5" from the nearest surface of the roof decking. In addition, cables, raceways, and enclosures shall not be installed in concealed locations of metal-corrugated sheet decking type roofing. Spacing from roof decking doesn't apply to rigid metal conduit or intermediate metal conduit.
9. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
  - a. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
10. Exterior raceways:
  - a. Install a minimum 24 inches below grade.
  - b. Where multiple conduit runs are indicated, they shall be installed in the same trench.
  - c. Where raceways stub into sub-grade levels, utilize installation methods to prevent migration of water into the building interior spaces.
  - d. All 90 degree ells 1" trade size or larger must be rigid steel conduit.
  - e. Transition to rigid steel conduit before the conduit is exposed.
  - f. Metallic conduit exterior or within building limits, that is 1" trade size or larger and in contact with earth, shall be galvanized rigid conduit with factory applied vinyl plastic coating or galvanized rigid conduit painted with heavy coat of bitumastic paint. Couplings shall be painted after assembly. Nicks in plastic coated conduit shall be painted with plastic material as recommended by the manufacturer. Where bitumastic paint is applied, the paint must be thoroughly dry prior to backfilling.
  - g. Provide warning tape in accordance with specification section 260500.
11. Raceways underground or under slabs:
  - a. All 90 degree ells 1" trade size or larger must be rigid steel conduit.
  - b. Transition to rigid steel conduit before the conduit is exposed.

- c. Metallic conduit exterior or within building limits, that is 1" trade size or larger and in contact with earth, shall be galvanized rigid conduit with factory applied vinyl plastic coating or galvanized rigid conduit painted with heavy coat of bitumastic paint. Couplings shall be painted after assembly. Nicks in plastic coated conduit shall be painted with plastic material as recommended by the manufacturer. Where bitumastic paint is applied, the paint must be thoroughly dry prior to backfilling.
  - d. Provide expansion fittings where conduits cross building expansion joints or where a wide temperature differential exists.
- 12. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 1 inch (25 mm) of concrete cover.
  - a. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - b. Space raceways laterally to prevent voids in concrete.
  - c. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - d. Provide expansion fittings where conduits cross building expansion joints or where a wide temperature differential exists.
- 13. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - a. Run parallel or banked raceways together on common supports.
  - b. 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.
- 14. Outlet boxes shall be concealed except where shown or noted otherwise. Outlet boxes, plaster rings or extension rings shall be installed flush with the finished surface.
- 15. Where applicable, outlet boxes for controls and operating mechanisms shall be installed to comply with ADA mounting height requirements.
- 16. Junction and Pull Boxes
  - a. Where necessary to terminate, tap-off, or redirect multiple conduit runs, provide and install appropriately sized junction boxes. Furnish and install pull boxes where necessary in the raceway system to facilitate conductor installation. Provide pull boxes to limit conduit runs to less than 150 feet and to contain no more than the equivalent of three right angle bends.
  - b. Use outlet boxes as junction boxes and pull boxes wherever possible and allowed by applicable codes. Make all boxes accessible and do not install boxes in finished areas. Mount all boxes plumb and level. Use flush mounted boxes with concealed conduits and make edges of boxes flush with the final surface.
  - c. Install boxes supported independently of conduit by attachment to the building structure or a structural member.
- 17. Join raceways with fittings designed and approved for that purpose and make joints tight.
  - a. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  - b. Use insulating bushings to protect conductors.
- 18. Tighten set screws of threadless fittings with suitable tools.
- 19. Terminations:
  - a. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
  - b. 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.

20. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
21. Telephone and Signal System Raceways for conduit cabling technique. 2-inch trade size (DN 53) and smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of three 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
22. Telephone and Signal System Raceways for free air cabling technique. 2 Inch Trade Size (DN 53) and smaller. Provide minimum  $\frac{3}{4}$  inch conduit from outlet box to 8 inches above accessible lay-in ceiling system, terminate with insulated bushing. Provide empty conduits, appropriately sized for the application, through floors and walls, above hard ceilings, and at exposed ceiling structure locations to provide clear and smooth pathways for cabling. Coordinate cable pathway requirements with data and voice cabling contractor.
23. 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:
  - a. Service entrance conduits.
  - b. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - c. Where conduits enter or exit the building.
  - d. Where otherwise required by NFPA 70.
24. 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 (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
25. Flexible Connections: Use maximum of 72 inches (48 inches in ducts and plenums) of flexible conduit for recessed and semi-recessed 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.
26. Do not utilize aluminum conduit.
27. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
  - a. Select each surface raceway outlet box, to which a lighting fixture is attached, to be of sufficient diameter to provide a seat for the fixture canopy.
  - b. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and canopy (with or without extension ring), no separate outlet box is required.
  - c. Provide surface metal raceway outlet box, backplate, and canopy at the feed-in location of each fluorescent lighting fixture having end-stem suspension.
  - d. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.
28. Set floor boxes level and flush with finished floor surface.
29. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
30. Handhole Access: Top of frames and covers flush with finished grade.
31. Direct Buried Conduit Backfill: Comply with Division 2 requirements.

B. Location of Outlets and Equipment.

1. Outlets shall be installed at the heights and approximate designated positions as shown on the Drawings and symbol legend, unless otherwise directed. Outlets in similar rooms shall be installed in the same relative location in each room. Outlets shall not be installed back to back but shall be offset approximately 6 inches.
2. Outlets shall be located to clear piping, ductwork, and other obstructions. Switch outlets shall be on the latch side of door except where type of construction dictates otherwise. Outlets in masonry or tile shall be located as far as practical adjacent to horizontal and vertical mortar joints to minimize cutting.
3. Verify locations and dimensions of electrical equipment, particularly in the case of door swings, heights of cabinets and counters, shelves, and location of equipment installed by the Owner or other trades.
4. Mounting heights indicated on the drawings shall be to center line of outlet unless indicated otherwise. Heights may be adjusted to align with mortar joints as specified above, however, all similar outlets in a given area shall be adjusted to the same height unless specifically noted at the outlet.
5. Receptacle outlets indicated to be installed "A.C." (above counter) shall be mounted not less than 3 inches higher than the top of the counter backsplash or at heights indicated.
6. All similar equipment such as panelboards, motor starters, disconnect switches, etc., shall be installed at the same heights throughout the building.

3.3 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.

3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 261300



THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 261400 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes receptacles, connectors, switches, and finish plates.

#### 1.3 SUBMITTALS

- A. Product Data: For each product specified.
- B. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NEMA WD 1.
- C. Comply with NFPA 70.

#### 1.5 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wiring Devices:
    - a. Bryant Electric, Inc.

- b. Eagle Electric Manufacturing Co., Inc.
- c. GE Company; GE Wiring Devices.
- d. Hubbell, Inc.; Wiring Devices Div.
- e. Killark Electric Manufacturing Co.
- f. Leviton Manufacturing Co., Inc.
- g. Pass & Seymour/Legrand; Wiring Devices Div.
- h. Pyle-National, Inc.; an Amphenol Co.

2. Poke-through, Floor Service Outlets and Telephone/Power Poles:

- a. American Electric.
- b. Hubbell, Inc.; Wiring Devices Div.
- c. Mono Systems, Inc.
- d. Pass & Seymour/Legrand; Wiring Devices Div.
- e. Square D Co.
- f. Wiremold.

## 2.2 RECEPTACLES

- A. Straight-Blade and Locking Receptacles: Hard use (heavy duty) specification grade, minimum 20A rating, side wired.
- B. Ranges and Clothes Dryers: Receptacles for ranges and clothes dryers shall be 3 pole, 4 wire grounding type.
- C. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a standard outlet box without an adapter.
- D. Dead Front GFCI Receptacles: Feed-through type, side wired, 20A rated, self test technology. Receptacles shall be equal to Hubbell CFBFST20.

## 2.3 PENDANT CORD/CONNECTOR DEVICES

- A. Description: Matching, locking type, plug and receptacle body connector, NEMA WD 6, Configurations L5-20P and L5-20R, Heavy-Duty grade.
  - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
  - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## 2.4 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.5 SWITCHES

- A. Snap Switches: Heavy-duty, quiet type, 20 amp, 120-277 volt – AC, with back and side wired screw terminals; Pass & Seymour PS20AC-1 or equal. Single-pole or three-way to suit connections.
- B. Dimmer Switches: Modular, full-wave, solid-state units. Compatible with dimming drivers or lamps being controlled and be rated for 600W or 125% of the connected load, whichever is greater.
  1. Control: On/Off switch with continuously adjustable slide switch.
  2. LED dimmer switches shall be equal to Leviton IP710-LFZ with color change kit.
  3. Filters: Include electromagnetic filter to reduce interference with radio, audio, and video equipment.
  4. Where three-way dimming is shown on the drawings true three-way dimming shall be provided utilizing a system equal to Acuity Controls nPP16 Power/Relay Pack with nPODM On/Off + Raise/Lower control switches.
  5. Do to the loads connected to the dimmer switches in the gym control panel, utilize a system equal to Acuity Controls nPP16 Power/Relay Pack with nPODM On/Off + Raise/Lower Control switch.

## 2.6 WALL PLATES

- A. Single and combination types match corresponding wiring devices.
  1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: ~~0.04-inch-~~ (1-mm-) thick, Type 302, satin-finished stainless steel.
  3. Material for Unfinished Spaces: Galvanized steel.
  4. Material for Wet Locations: Heavy duty die-cast zinc.
    - a. Where required by the authority having jurisdiction, receptacle covers shall be “While in Use”, “Extra-Duty” type, equal to Intermatic WP3110MXD, or WP1030MXD, or WP1010HMXD series, consisting of heavy duty die cast construction with lockable hasp.
    - b. Switch covers shall be similar to Steel City SW series.

## 2.7 FLOOR SERVICE FITTINGS

- A. Floor Boxes: See Specification Section 261300.
- B. Power Receptacle: NEMA WD 6, Configuration 5-20R, gray finish, unless otherwise indicated.
- C. Signal Outlet: Standard receptacle plate compatible with service unit and phone/data adapter to fit plate.

## 2.8 WIRING DEVICE FINISHES

- A. Color: Gray, unless otherwise indicated or required by Code.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Switches shall be installed so that the handle is down when the switch is in the off position.
- B. Receptacle and switch branch circuit wiring shall be terminated on the side wired screw terminals.
- C. In storage, mechanical, and electrical equipment rooms where the receptacle is located adjacent to the light switch at 46" AFF, the devices shall be installed in a combination cover-plate and back-box assembly.
- D. GFI Receptacles: Ground fault circuit-interruption for personnel shall be provided in accordance with the NEC articles 210.8 and 422.5 or noted on the drawings.
  - 1. The ground-fault circuit-interrupter shall be installed in a readily accessible location or provide dead-front GFI device at accessible location to protect receptacle.
  - 2. If GFI receptacle is not available provide GFI circuit breaker in panelboard serving the receptacle.
- E. Wet Locations: All 15- and 20-ampere 125- and 250-volt nonlocking receptacles shall be listed weather-resistant type.
- F. Install devices and assemblies level, plumb, and secure.
- G. Where applicable, devices for controls and operating mechanisms shall be installed to comply with ADA mounting height requirements.
- H. Install wall plates when painting is complete.
- I. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.
  - 1. Exterior receptacles shall be installed with long dimension horizontal, mounting height of approximately 25" above finish grade.
- J. Orientation of Receptacles: Install with grounding terminal of receptacles on the top.
- K. Protect devices and assemblies during painting.
- L. Adjust locations at which floor service outlets are installed to suit arrangement of partitions and furnishings.

### 3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods."

1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.
2. Receptacles: Identify panelboard and circuit number from which served. Use durable wire markers or tags within outlet boxes.
3. Where receptacles are supplied through a GFCI breaker or connected “downstream” of a GFCI receptacle, the receptacle shall be marked “GFCI Protected”.
4. Where receptacles are controlled by an automatic control device the receptacles shall be marked in accordance with NEC article 406.3.

### 3.3 CONNECTIONS

- A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- B. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A.
- C. Where multiple sets of conductors terminate at a box, provide pigtails to devices such that the continuity of the branch circuit conductors is not dependent upon device connections and the continuing load is not routed through the device. See section 261200 – Conductors and Cables.

### 3.4 FIELD QUALITY CONTROL

- A. Test wiring devices for proper operation, polarity and ground continuity.
- B. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- C. Replace damaged or defective components.

### 3.5 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION 261400

THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 261450 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes occupancy/vacancy sensors & controls and multipole lighting relays & contactors.

#### 1.3 SUBMITTALS

- A. Product Data: Include dimensions and data on features, components, and ratings for lighting control devices. Provide layout drawings showing all device locations, connection requirements and coverage.
- B. Maintenance Data: For lighting control devices to include in maintenance manuals specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- C. Comply with NFPA 70.

#### 1.5 COORDINATION

- A. Coordinate features of devices specified in this Section with systems and components specified in other Sections to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions. Include coordination with the following:
  - 1. Division 26 Section "Panelboards."
  - 2. Division 26 Section "Interior Lighting."
  - 3. Division 26 Section "Exterior Lighting."

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



1. Contactors and Relays:
  - a. Cutler-Hammer Products; Eaton Corporation.
  - b. GE Lighting Controls.
  - c. Hubbell Lighting, Inc.
  - d. Siemens Energy and Automation, Inc.
  - e. Square D Co.; Power Management Organization.
2. Occupancy Sensors and Controls:
  - a. GE Lighting Controls
  - b. Hubbell Lighting, Inc.
  - c. Leviton Lighting Controls
  - d. Steinel Controls
  - e. Watt Stopper, Inc.

## 2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

- A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations

## 2.3 OCCUPANCY/VACANCY SENSORS & CONTROLS

- A. The following sensor types are recommended for the applications as shown on the drawings, however the installing contractor shall install one or more sensors in all areas shown with occupancy sensors that cover the entire space and all entrance points. The exact type, placement, and quantity of sensors required shall be per the manufacturer's best practice recommendations. Provide sensors in accordance with applicable energy codes.
  1. The contractor and manufacturer's representative shall review floor plans and reflected ceiling plans to determine requirements.
    - a. Large rooms with more than one sensor: Similar to Watt Stopper DT-305-U Dual Technology Low Voltage Ceiling Sensor with associated BZ-50 Power Pack.
    - b. Small Restrooms: Similar to Watt Stopper UT-355-2-U Ultrasonic Line Voltage Ceiling Sensor.
    - c. Large Restrooms: Similar to Watt Stopper UT-355-3-U Ultrasonic Line Voltage Ceiling Sensor.
    - d. Wall box occupancy sensors: Similar to Watt Stopper DW-100 wall switch sensor, configured for manual on operation.
      - 1) Devices shall have gray finish.

## 2.4 MULTIPOLE CONTACTORS AND RELAYS

- A. Description: Electrically operated and electrically held, and complying with UL 508 and NEMA ICS 2.
  1. Current Rating for Switching: UL listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballasts with 15 percent or less total harmonic distortion of normal load current).
  2. Control Coil Voltage: Match control power source.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install equipment level and plumb and according to manufacturer's written instructions.
- B. Mount lighting control devices according to manufacturer's written instructions and requirements in Division 26 Section "Basic Electrical Materials and Methods."
- C. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

### 3.2 CONTROL WIRING INSTALLATION

- A. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Division 26 Section "Conductors and Cables" for low-voltage connections and Division 26 Section "Voice and Data Systems" for digital circuits.
- B. Wiring Method: Install all wiring in raceway as specified in Division 26 Section "Raceways and Boxes," unless run in accessible ceiling space and gypsum board partitions. Wiring shall be listed and labeled for plenum installation in plenum locations.
- C. Bundle, train, and support wiring in enclosures.
- D. Ground equipment.
- E. Connections: 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.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- B. Lighting Control Enclosure Nameplates: Label each lighting control panel and contactor with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

### 3.4 FIELD QUALITY CONTROL

- A. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.
- B. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.
- C. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
  - 1. Continuity tests of circuits.
  - 2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

- a. Include testing of devices under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
- D. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

### 3.5 CLEANING

- A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

### 3.6 DEMONSTRATION

- A. Coordinate with training for low-voltage, programmable lighting control system specified in Division 26 Section "Lighting Controls."
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
  - 1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of four hours' training.
  - 2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
  - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

### 3.7 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust sensors and controls to suit actual conditions.

END OF SECTION 261450

## SECTION 262890 – SURGE PROTECTION DEVICES (SPD's)

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes surge protection devices for low-voltage power, control, and communication equipment.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Product Certificates: Signed by manufacturers of surge protection devices, certifying that products furnished comply with the following testing and labeling requirements:
  - 1. UL 1283 certification.
  - 2. UL 1449 listing and classification (third edition).
- C. Maintenance Data: For surge protection devices to include in maintenance manuals specified in Division 1.
- D. Warranties: Special warranties specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain surge protection devices 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. Surge protection devices shall be designed in accordance with ANSI/IEEE C62.41.1-2002, C62.41.2-2002, and C62.45-2002.
- D. UL Compliance: Comply with Underwriters Laboratories ANSI/UL 1283, 5<sup>th</sup> Edition - "Electromagnetic Interference Filters" (applies to type 2 SPD's).
- E. UL Compliance: Comply with Underwriters Laboratories ANSI/UL 1449 3<sup>rd</sup> Edition – "Surge Protective Devices".

## 1.5 PROJECT CONDITIONS

- A. Placing into Service: Do not energize or connect panelboards to their sources until the surge protective devices are installed and connected.
- B. Service Conditions: Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
  - 2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
  - 3. Humidity: 0 to 85 percent, noncondensing.

## 1.6 COORDINATION

- A. Coordinate location of field-mounted surge protectors to allow adequate clearances for maintenance.
- B. Coordinate surge protective devices with Division 16 Section "Electrical Power Monitoring and Control."

## 1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship for a period of not less than ten years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Manufacturers of a Broad Line of Surge Protection Devices:
    - a. Advanced Protection Technologies.
    - b. Eaton Corp.; Cutler-Hammer Products.
    - c. General Electric.
    - d. Intermatic.
    - e. Liebert/Emerson.
    - f. Square D by Schneider Electric.
  - 2. Manufacturers of Category A and Telephone/Data Line Suppressors:
    - a. EDCO (Emerson Network Power Surge Protection).

- b. MCG Electronics, Inc.
- c. NTE Electronics, Inc.
- d. Telebyte Technology, Inc.

## 2.2 SERVICE ENTRANCE SURGE PROTECTION DEVICES (Main Distribution Panels “HDPF”).

- A. Type 2 SPD’s, comply with ANSI/UL 1283.
- B. Surge Protective Device Description: Modular type with the following features and accessories:
  - 1. The system shall be designed for easy servicing by a qualified field electrician, providing simple change out of any or all TVSS modules. Designs that require factory service are not acceptable. Any unit using “plug-in” type modules are not acceptable. All connections, conductors, and terminals must be appropriately sized for specified surge current capacity.
  - 2. LED indicator lights for power and protection status.
  - 3. Audible alarm, with silencing switch, to indicate when protection has failed.
  - 4. One set of dry contacts rated at a minimum of 2A and 24Vdc, for remote monitoring of protection status.
  - 5. Redundant suppression circuits.
  - 6. Minimum withstand rating of 20kA per mode.
  - 7. Redundant replaceable modules (if Surge Current Rating is above 200kA per phase).
  - 8. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
  - 9. Surge-event operations counter.
- C. Surge Current Rating: 150kA per mode, 300kA per phase.
- D. Connection Means: Permanently wired.
- E. Protection modes and UL 1449 voltage protection for grounded wye circuits with voltages of 480Y/277, 3-phase, 4-wire circuits, shall be as follows:
  - 1. Line to Neutral: 1200V.
  - 2. Line to Ground: 1200V.
  - 3. Neutral to Ground: 1200V.
  - 4. Line to Line: 2000V.
- F. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the AIC rating of the associated switchboard or panelboard to which the SPD is being connected
- G. Nominal Discharge Current Rating:
  - 1. Surge protective devices must carry a minimum Nominal Discharge Current Rating of 20kA to meet the requirements of UL96A – Installation Requirements for Lightning Protection Systems.

## 2.3 PANELBOARD SURGE PROTECTION DEVICES (Distribution Panel “LDPF”).

- A. Type 2 SPD’s, comply with ANSI/UL 1283.
- B. Surge Protective Device Description: Modular type with the following features and accessories:

1. The system shall be designed for easy servicing by a qualified field electrician, providing simple change out of any or all TVSS modules. Designs that require factory service are not acceptable. Any unit using "plug-in" type modules are not acceptable. All connections, conductors, and terminals must be appropriately sized for specified surge current capacity.
  2. LED indicator lights for power and protection status.
  3. Audible alarm, with silencing switch, to indicate when protection has failed.
  4. One set of dry contacts rated at a minimum of 2A and 24Vdc, for remote monitoring of protection status.
  5. Redundant suppression circuits.
  6. Minimum withstand rating of 20kA per mode.
  7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
  8. Surge-event operations counter.
- C. Surge Current Rating: 60kA per mode, 120kA per phase.
- D. Protection modes and UL 1449 voltage protection for grounded wye circuits with voltages of 208Y/120 V, three-phase, 4-wire circuits, shall be as follows:
1. Line to Neutral: 800 V.
  2. Line to Ground: 800 V.
  3. Neutral to Ground: 800 V.
  4. Line to Line: 1200V.
- E. SCCR: Per NEC 285.6, the short circuit current rating of the SPD shall be equal to or greater than the AIC rating of the associated switchboard or panelboard to which the SPD is being connected
- F. Nominal Discharge Current Rating:
1. Surge protective devices must carry a minimum Nominal Discharge Current Rating of 10kA.

## 2.4 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.
1. Wet Locations: Type 4.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
1. Provide multipole circuit breaker as a dedicated disconnect for the SPD, unless otherwise indicated.
- B. Install devices for panelboard and auxiliary panels with conductors between SPD and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multipole circuit breaker as a dedicated disconnect for the SPD, unless otherwise indicated.

### 3.2 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

### 3.3 FIELD QUALITY CONTROL

- A. Testing: Units shall be factory tested and be connected by following factory installation instructions by a qualified licensed electrician.
- B. Testing: Perform the following field quality-control testing:
  1. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.
  2. Complete startup checks according to manufacturer's written instructions.
  3. Perform each visual and mechanical inspection test stated in NETA ATS, Section 7.19.
- C. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

### 3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain surge protective devices.
  1. Train Owner's maintenance personnel on procedures and schedules for maintaining suppressors.
  2. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
  3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 262890



THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 264100 - ENCLOSED SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches used for the following:
  - 1. Service disconnecting means.
  - 2. Motor and equipment disconnecting means.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of switch, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switch.
  - 1. 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. Mark each product data sheet with the tag number and equipment description indicated on the mechanical equipment schedule and/or power riser diagram.
    - b. Enclosure types and details for types other than NEMA 250, Type 1.
    - c. Current and voltage ratings.
    - d. Short-circuit current rating.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For enclosed switches and for components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
  - 1. Routine maintenance requirements for components.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA AB 1 and NEMA KS 1.
- C. Comply with NFPA 70.

#### 1.5 COORDINATION

- A. Coordinate layout and installation of switches 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.
- B. Coordinate features, accessories, and functions of each enclosed switch with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fusible and Nonfusible Switches:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electric Co.; Electrical Distribution & Control Division.
    - c. Siemens Energy & Automation, Inc.
    - d. Square D Co.

#### 2.2 ENCLOSED SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 1600 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle, and interlocked with cover in closed position.

#### 2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.

2. Other Wet Locations: NEMA 250, Type 4.

## 2.4 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosures before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches for compliance with installation tolerances and other conditions affecting performance.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install enclosed switches in locations as indicated, according to manufacturer's written instructions. Verify that the installation will be readily accessible and will provide the clearances as required by the NEC article 110-26.
- B. Exterior Enclosures: Mount enclosures at elevations to maximize aesthetics and minimize viewing angles by the public.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- B. Enclosure Nameplates: Label each enclosed switch with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Label shall indicate the equipment being served.

### 3.4 CONNECTIONS

- A. Install equipment grounding connections for switches with ground continuity to main electrical ground bus.
- B. Install power wiring. Install wiring between switches and control and indication devices.
- 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.

### 3.5 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test continuity of each line- and load-side circuit.
- B. Testing: After installing enclosed switches and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection test indicated in NETA ATS, Section 7.5 for switches.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. 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 264100

## SECTION 264200 - ENCLOSED CONTROLLERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes ac general-purpose controllers rated 600 V and less that are supplied as enclosed units.

#### 1.3 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.
  - 1. Mark each product data sheet with the tag number and description indicated on the mechanical equipment schedule.
- B. Maintenance Data: For enclosed controllers and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Closeout Procedures," include the following:
  - 1. Routine maintenance requirements for enclosed controllers and all installed components.
- C. 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.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain, within 150 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.
- B. Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NFPA 70.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

## 1.6 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 of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.
- C. 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

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Manual and Magnetic Enclosed Controllers:
    - a. Eaton Corp.; Cutler-Hammer Products.
    - b. General Electrical Distribution & Control.
    - c. Rockwell Automation Allen-Bradley Co.; Industrial Control Group.
    - d. Siemens/Furnas Controls.
    - e. Square D Co.

### 2.2 MAGNETIC ENCLOSED CONTROLLERS

- A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
- B. Control Circuit: 120 or 24 V (coordinate with mechanical contractor); obtained from integral control power transformer with secondary fuse protection. The control power transformer shall have sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
- C. Combination Controller: Factory-assembled combination controller and disconnect switch.
  - 1. Nonfusible Disconnecting Means: NEMA KS 1, heavy-duty, nonfusible switch.
- D. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Class 10 tripping characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.

- E. Adjustable Overload Relay (shall be provided for all starters associated with 3 phase motors rated at 5HP or larger): Solid state, 3 to 1 adjustment for trip current, and protect motor against voltage and current unbalance and phase loss.

## 2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

- 1. Wet Locations: NEMA 250, Type 4.

## 2.4 MANUAL MOTOR CONTROLLERS

- A. Fractional Horsepower Manual Starters: NEMA ICS 2; AC general purpose Class A manually operated, 1 or 2 pole, full-voltage controller rated for 1 horsepower, with adjustable one-piece melting alloy type thermal overload unit rated for connected load, and toggle operator, suitable for flush mounting in finished spaces. NEMA 3R lockable controller for exterior locations.

## 2.5 ACCESSORIES

- A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Furnish each controller with red-run and green-off LED type indicating lights, 2 auxiliary M contacts.
- D. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

## 2.6 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

# PART 3 - EXECUTION

## 3.1 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, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Use fractional horsepower manual controllers for single-phase motors, unless otherwise indicated.



- D. Use manual controllers for 3-phase motors up to 5 horsepower not requiring automatic or remote control.
- E. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.
- F. Hand-Off-Automatic Selector Switches: Provide in covers of manual and magnetic controllers of motors started and stopped by automatic controls or interlocks with other equipment.

### 3.2 INSTALLATION

- A. Install enclosed controllers in locations as indicated, according to manufacturer's written instructions. Verify that the installation will be readily accessible and will provide the clearances as required by the NEC article 110-26.
- B. See Division 26 Section "Basic Electrical Materials and Methods" for general installation requirements.
- C. Install independently mounted control devices according to manufacturer's written instructions.
- D. Locate controllers within sight of motors controlled, unless otherwise indicated.
- E. 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 "Basic Electrical Materials and Methods."

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- B. Enclosure Nameplates: Label each enclosed controller with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws. Label shall indicate the equipment being served.

### 3.4 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.

### 3.5 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.

### 3.6 FIELD QUALITY CONTROL

- A. Testing: After installing controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements. Perform the following field quality-control testing:
  - 1. Perform each visual and mechanical inspection indicated in NETA ATS, Sections 7.5, 7.6, and 7.16.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### 3.7 CLEANING

- A. Clean enclosed controllers internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.
- B. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

### 3.8 STARTUP SERVICE

- A. Verify that enclosed controllers are installed and connected according to the Contract Documents.
- B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.
- C. Complete installation and startup checks according to manufacturer's written instructions.

### 3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.
  - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
  - 2. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 264200

THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 264420 - PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:
  - 1. Lighting and appliance branch-circuit panelboards.
  - 2. Distribution panelboards.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Bus configuration, current, and voltage ratings.
    - c. Short-circuit current rating of panelboards and overcurrent protective devices.
    - d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:
  - 1. Panelboard Schedules: For installation in panelboards. Submit final versions.
    - a. Copies of panelboard schedules shall be provided in the operation and maintenance manuals in case circuit directories in the panelboards are lost.
  - 2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
- D. Panelboard Overcurrent Protection Device Arrangement: To the extent possible, coordinate with panelboard supplier for correct arrangement of overcurrent protection devices (OCPD's) within panelboards to match panelboard schedules shown on the electrical drawings. The

contractor shall rearrange OCPD's if necessary to match the schedules shown on the electrical drawings.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

#### 1.5 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.

#### 1.6 EXTRA MATERIALS

- A. Keys: Four spares of each type of panelboard cabinet lock.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:
    - a. American Midwest Power.
    - b. Eaton Corp.; Cutler-Hammer Products.
    - c. General Electric Co.; Electrical Distribution & Control Div.
    - d. Schneider Electric (Square D Co.)
    - e. Siemens Energy & Automation, Inc.

#### 2.2 FABRICATION AND FEATURES

- A. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.
  - 1. Outdoor Locations: NEMA 250, Type 3R.
  - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- B. Covers:

1. Provide hinged front trim cover with front trim hinged to box with standard circuit breaker access door within hinged trim cover. Provide flush latch with tumbler lock for circuit breaker access door.
- C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
- D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.
- E. Phase, Neutral, and Ground Bus Material: Material shall be determined by the conductor material being used for this project. If copper conductors are being used, bus material shall be 98 percent conductivity copper. If aluminum conductors are being used, bus material shall be tin-plated, high-strength, electrical-grade aluminum alloy.
  1. If bus is aluminum, use copper or tin-plated aluminum for circuit-breaker line connections.
  2. If bus is copper, use copper for feeder circuit-breaker line connections.
- F. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.
- G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
- H. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- I. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.
- J. Feed-through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

## 2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

## 2.5 DISTRIBUTION PANELBOARDS

- A. Doors: Front mounted, except omit in fused-switch panelboards; secured with vault-type latch with tumbler lock; keyed alike.
- B. Main Overcurrent Protective Devices: Circuit breaker.
- C. Branch overcurrent protective devices shall be one of the following:
  1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

## 2.6 SERVICE ENTRANCE SURGE PROTECTION DEVICES

- A. See Specification Section 262890 – Surge Protection Devices.
  1. Service entrance surge protection devices shall be provided for main distribution panel “HDPF”.
  2. Surge protection devices shall be external to panelboards.

## 2.7 PANELBOARD SURGE PROTECTION DEVICES

- A. See Specification Section 262890 – Surge Protection Devices.
  1. Panelboard surge protection devices shall be provided for distribution panel “LDPF”.
  2. Surge protection devices shall be external to panelboards.

## 2.8 OVERCURRENT PROTECTIVE DEVICES

- A. 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. GFCI Circuit Breakers for Personnel Protection: Single- and two-pole configurations with 5-mA trip sensitivity.
  3. GFCI Circuit Breakers for Equipment Protection: Single- and two-pole configurations with 30-mA trip sensitivity.
- B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
  1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.
  2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
  3. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

## 2.9 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

- C. Mounting: Surface mount panelboards shall be mounted to ¾" plywood backboards. Paint backboards with two coats of grey fire retardant paint.
- D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
  - 1. Room names or Owner's room numbers shall be used. Do not use plan room numbers unless approved by the owner.
  - 2. Spare circuit breakers shall be identified as such.
- F. Install filler plates in unused spaces.
- G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

## 2.10 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- B. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
  - 1. Lighting and Appliance Panelboards: Each lighting and appliance panelboard label shall indicate the panelboard name, voltage and phase, and where the panel is fed from.
  - 2. Distribution Panelboards: Label each distribution panelboard section and overcurrent protection device (OCPD). Each section label shall indicate distribution panelboard name, section, voltage and phase, and where the panel is fed from. Each OCPD label shall indicate the device being protected.

## 2.11 CONNECTIONS

- A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.
- B. 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.

## 2.12 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
  - 1. Test continuity of each circuit.



- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
  - 1. Procedures: Perform each visual and mechanical inspection test indicated in NETA ATS, Section 7.6 for molded-case circuit breakers.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- C. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:
  - 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.

#### 2.13 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

#### 2.14 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 264420

## SECTION 264610 - DRY-TYPE TRANSFORMERS (1000 V AND LESS)

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes dry-type distribution and specialty transformers rated 1000 V and less.

#### 1.3 SUBMITTALS

- A. Product Data: Include data on features, components, ratings, and performance for each type of transformer specified. Include dimensioned plans, sections, and elevation views. Show minimum clearances and installed devices and features.
- B. Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting field-installed wiring.
- C. Factory Test Reports: Certified copies of manufacturer's routine factory tests required by referenced standards.
- D. Maintenance Data: For transformers to include in the maintenance manuals specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide transformers specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
- B. Comply with IEEE C2.
- C. Comply with NFPA 70.
- D. Comply with NEMA TP1.
- E. Comply with 10 CFR-Part 431.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is

not energized and is not in a space that is continuously under normal control of temperature and humidity.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide transformers by one the following:
  - 1. Challenger Electrical Equipment Corp.
  - 2. Computer Power Inc.
  - 3. Cutler-Hammer/Eaton Corp.
  - 4. GE Electrical Distribution & Control.
  - 5. Hammond Power Solutions, Inc.
  - 6. MagneTek Inc.
  - 7. Schneider Electric (Square D Co.)
  - 8. Siemens Energy & Automation, Inc.

### 2.2 TRANSFORMERS, GENERAL

- A. Description: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
- B. Energy Efficiency: Transformers shall be low loss type with minimum efficiencies per NEMA TP1. Efficiency shall be tested in accordance with NEMA TP2.
- C. Cores: Grain-oriented, nonaging silicon steel.
- D. Coils: Electrical grade aluminum. Continuous windings without splices, except for taps.
- E. Internal Coil Connections: Brazed or pressure type.
- F. Enclosure: Class complies with NEMA 250 for the environment in which installed.

### 2.3 GENERAL-PURPOSE DISTRIBUTION AND POWER TRANSFORMERS

- A. Comply with NEMA ST 20 and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Windings: One coil per phase in primary and secondary.
- D. Enclosure: Ventilated, raintight, NEMA 250, Type 3R.
- E. Insulation Class: 185 or 220 deg C class for transformers 15 kVA or smaller; 220 deg C class for transformers larger than 15 kVA.
  - 1. Rated Temperature Rise: 150 deg C maximum rise above 40 deg C, for 220 deg C class insulation; 115 deg C maximum rise for 185 deg C class insulation.

- F. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:
  - 1. Taps, 15 through 500 kVA: Four 2.5-percent taps, 2 above and 2 below rated high voltage.
- G. Vibration Isolation Pads: Incorporate vibration isolation pads located between the transformer core and coil assembly and the transformer case. There shall be no metal-to-metal contact between the core and coil assembly and the transformer case.

## 2.4 CONTROL AND SIGNAL TRANSFORMERS

- A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.
- B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.
- C. Description: Self-cooled, 2 windings.

## 2.5 FINISHES

- A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.

## 2.6 SOURCE QUALITY CONTROL

- A. Factory Tests: Design and routine tests comply with referenced standards.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Comply with safety requirements of IEEE C2.
- B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.
- 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.

## 3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."
- B. Transformer Nameplates: Label each transformer with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
  - 1. Each transformer label shall indicate the transformer name, primary and secondary voltage and phase, KVA rating, and where the transformer is fed from.

### 3.3 GROUNDING

- A. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping as indicated and to comply with NFPA 70.
- B. Comply with Division 26 Section "Grounding" for materials and installation requirements.

### 3.4 FIELD QUALITY CONTROL

- A. Test Objectives: To ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.
- B. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.
  - 1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
  - 2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A.
- C. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

### 3.5 CLEANING

- A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

END OF SECTION 264610

## SECTION 264910 - FUSES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes cartridge fuses, rated 600 V and less, for use in switches.

#### 1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
  - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 2. Let-through current curves for fuses with current-limiting characteristics.
  - 3. Time-current curves, coordination charts and tables, and related data.
- B. Ambient Temperature Adjustment Information. If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses adjusted.
  - 1. For each adjusted fuse, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  - 2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
- C. Maintenance Data: For tripping devices to include in maintenance manuals specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Provide fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NEMA FU 1.
- D. Comply with NFPA 70.

#### 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (4.4 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## 1.6 COORDINATION

- A. Coordinate fuse ratings with HVAC and refrigeration equipment nameplate limitations of maximum fuse size.
- B. Coordinate fuse ratings for Type 2 protection of motor starters, contacts, and overload relays.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged in original cartons or containers and identified with labels describing contents.
  - 1. Fuses: Quantity equal to twenty percent of each fuse type and size, but not fewer than one set of three of each type and size.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.; Bussmann Div.
  - 2. General Electric Co.; Wiring Devices Div.
  - 3. Gould Shawmut.
  - 4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FUSE APPLICATIONS

- A. Main Service and Feeders, 600A maximum: Class RK1, dual-element, time-delay.
- B. Motor Branch Circuits: Class RK5 or Class J, dual-element, time-delay.
- C. Other Branch Circuits: Class RK1, fast-acting.

### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

### 3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 264910



THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 265110 - INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
  - 1. Dimensions of fixtures.
  - 2. Certified results of laboratory tests for fixtures and lamps for photometric performance.
  - 3. Emergency lighting unit battery and charger.
- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
  - 1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- C. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

#### 1.5 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

## 1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. LED Drivers: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each designation in the Lighting Fixture Schedule.

### 2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging. All parts shall be painted after fabrication to facilitate installation, increase efficiency, and inhibit rusting.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
- D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
  - 1. White Surfaces: 90 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
  - 4. Laminated Silver Metallized Film: 90 percent.
- E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
  - 1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
  - 2. Lens Thickness: 0.125 inch (3 mm) minimum, unless greater thickness is indicated.

## 2.3 LIGHTING FIXTURES

- A. See the "Lighting Fixture Schedule" on plans.
  - 1. Upper case letter at fixture outlet symbol or in note on Drawings indicated the fixture type. Lower case letter at fixture symbol indicated switching circuit. Any outlets not specifically labeled shall be equipment with fixture similar to those in rooms used for like purposes.
  - 2. Fixtures requiring plaster frames or other special frames shall be furnished with these frames as required for type of construction. Fixtures requiring additional accessible outlet connection boxes and additional wiring from outlet box to fixture, shall be furnished with this wiring per the N.E.C. and Local Code requirements. Frames of all recessed fixtures shall be tight to the ceiling to eliminate light leaks. Gasketing shall be used to eliminate all light leaks.

## 2.4 EXIT SIGNS

- A. General Requirements: Comply with UL 924 and the following:
  - 1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.
- B. Internally Lighted Signs: As follows:
  - 1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

## 2.5 FIXTURE SUPPORT COMPONENTS

- A. Comply with Division 26 Section "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.
- C. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

## 2.6 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
  - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects, after fabrication.
  - 2. Metallic Finish: Corrosion resistant.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
  - 1. Where specific lamp designations are not indicated or specified, lamp fixtures according to manufacturer's recommendations.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
  - 1. For fixtures with a weight greater than 7 lbs per square foot of occupied ceiling space, install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners. These rods or wires shall be secured to individual support points directly vertical from attachment point to fixture to the extent possible.
  - 2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
- C. Exit Light Installation in Grid-Type Suspended or Gyp Board Ceilings:
  - 1. Support electrical boxes firmly to the deck structure utilizing uni-strut or other acceptable means. Fixtures shall not be easily turned or rotated from below.
- D. Suspended Fixture Support: As follows:
  - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
  - 3. Continuous Rows: Suspend from cable or chain installed according to fixture manufacturer's written instructions and details on Drawings.
- E. Emergency Lighting Fixtures: Provide unswitched normal building power to all fixtures provided with generator transfer devices for local power failure indication. The unswitched power connection shall be from a branch circuit serving the lighting in the space in which the emergency lighting is located.

### 3.2 CONNECTIONS

- A. Ground equipment.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

### 3.3 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Tests: As follows:
  - 1. Verify normal operation of each fixture after installation.

2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
  3. Verify normal transfer to battery source and retransfer to normal.
  4. Report results in writing.
- C. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.
- D. Corrosive Fixtures: Replace during warranty period.

### 3.4 CLEANING AND ADJUSTING

- A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

END OF SECTION 265110

THIS PAGE INTENTIONALLY LEFT BLANK

## SECTION 277400 - COMMUNICATION AND DATA-PROCESSING EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes wire, cable, connecting devices, installation, and testing for wiring systems to be used as signal pathways for voice and high-speed data transmission and local A/V distribution.
- B. The data transmission system shall be a Manufacturer Certified Category 6 (6A for wireless access points) system as specified and indicated on the drawings. Warranty shall be a minimum of fifteen years.
  - 1. The system shall incorporate commercial grade products as specified. Lead frame and residential grade products are not acceptable.
- C. This Specification Section has also been expanded to include the infrastructure cabling necessary to support local audio-video (A/V) distribution between A/V source and destination equipment within the confines of specific rooms, as noted on the plans.
- D. Audio-Video (A/V) Hardware Exclusions
  - 1. This specification section limits audio-video (A/V) distribution to the actual hardwired infrastructure (wiring, cabling, outlets and terminations) and does NOT address nor make provisions for furnishing, installing, setting up or testing any type of external or equipment specific hardware, patch cables or jumper cables that may be necessary to actually final terminate and interconnect various types of A/V hardware pieces together.
  - 2. It is understood that all active audio-video equipment; including but not limited to players and receivers (such as- VCR's, DVD players, CD players, laptop computers, central process controllers, projectors, TV sets, twisted pair transceivers, etc.) is to be "Owner Provided" OUTSIDE the scope of this project and this specification.
  - 3. Likewise, audio-video (A/V) patch cables and jumpers are also excluded from the scope of this project and this specification.

#### 1.3 SUBMITTALS

- A. Submittals shall be provided in accordance with Division 1 and as further described herein.
- B. Submittals shall include major equipment material lists, summarizing every item to be provided, by manufacturer, part number, quantity, and include a brief summary of each item. Manufacturer's product data sheets, describing each of the major components shall also be provided.



- C. Submittals shall be tab divided by system to aid in identifying the products associated with each system.
- D. Shop Drawings: Include dimensioned plan and elevation views of components. Show access and workspace requirements.
  - 1. System labeling schedules, including electronic copy of labeling schedules, as specified in Part 3, in software and format selected by Owner.
- E. Product Certificates: Signed by manufacturers of cables, connectors, and equipment certifying that products furnished comply with requirements.
- F. Qualification Data: Submit evidence that the firms and persons scheduled by this contractor to execute the installation, termination and testing of the communication and data processing equipment are qualified to properly complete all work required and that they are properly registered or certified as specified in the "Quality Assurance" Article.
- G. Maintenance Data: For products to include in maintenance manuals specified in Division 1.
  - 1. Descriptions of all equipment and normal operating procedures.
  - 2. Provide as-built floor plan drawings showing all installed outlets with label ID's and cabling designation and routing information.
  - 3. Provide riser diagrams showing all cabling as installed.
  - 4. Provide warranty information required by manufacturers for submission of warranty claims for all materials installed.
  - 5. Include a complete proof of performance report outlining the operating parameters tested, complete test results and a review of industry standards for each parameter. One copy of test results in electronic format accompanied with the software from the test equipment manufacturer to view and update test results must also be included.
  - 6. Include proof of calibration for all copper and fiber test equipment.

#### 1.4 QUALITY ASSURANCE

- A. This contractor shall be a firm that specializes in this type of work and shall, upon request, provide documentation of a minimum of three other successfully completed projects of similar size and magnitude that they are responsible for completing.
- B. Designer & Installer Qualifications:
  - 1. Engage the services of a Telecommunications Contracting Firm, which has experienced BICSI certified individuals on staff. The foreman on the jobsite shall be a BICSI certified RCDD or BICSI Technician. Half the installing labor force shall be a least BICSI Installers.
- C. On the date of document issue, this contractor shall be a certified installer by:
  - 1. AMP, Inc.
  - 2. Belden.
  - 3. CommScope, Inc.
  - 4. Hitachi Cable America, Inc.
  - 5. Hubbell Premise Wiring, Inc.
  - 6. ADC/Krone, Inc.

7. Leviton Network Solutions.
  8. Optical Cable Corporation.
  9. Ortronics, Inc.
  10. Panduit Corporation, Network Systems Division.
  11. Siemon Company.
  12. Signamax Connectivity Systems.
- D. This contractor and all employees working on the jobsite shall currently meet all manufacturer's requirements for the provision of all equipment specified herein. This contractor shall provide certification that all assigned staff have attended training courses corresponding to the types of cabling and installations specified herein.
- E. This contractor shall be familiar with and utilize the following reference documents and codes throughout the course of equipment installation.
1. ANSI/TIA/EIA-568-B.1 Commercial Building Telecommunications Cabling Standard and all addendums.
  2. ANSI/TIA/EIA-568-B.2 Commercial Building Telecommunications Cabling Standard Part 2: Balanced Twisted-Pair Cabling Components and all addendums.
  3. ANSI/TIA/EIA-568-B.3 Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components Standard and all addendums.
  4. ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces.
  5. ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
  6. BICSI Telecommunications Distribution Methods Manual, most recent edition.
  7. BICSI Telecommunications Cabling Installation Manual, most recent edition.
  8. NFPA-70 National Electrical Code, most recent adopted edition.
  9. NECA/BICSI-568-A Standard for Installing Commercial Building Telecommunications Cabling.
  10. Federal Communications Commission Part 15 and Part 68.
  11. UL 444 – Standard for Safety of Communications Cable.
  12. UL 1666 – Standard for Safety of Flame Propagation Height.
  13. NFPA 262 – Flame Travel and Smoke of Wires and Cables.
  14. Any additional requirements of the Local Authority Having Jurisdiction.
- F. This contractor shall utilize and have operators trained in the utilization of the following test equipment:
1. Copper Cable Test Equipment
    - a. Fluke DTX 1800, or approved equal.
    - b. JDSU NGC-4500, or approved equal.
  2. Fiber Optic Cable Test Equipment
    - a. Tektronix OTDR-OF-150, HP-E6000A OTDR, Siecor 2001HR, or approved equal.
    - b. Fotec M210A, Siecor OM-100F, or equal.
    - c. Fotec S370, Siecor OS-100D, or equal.

- G. All products provided as part of this project shall be manufactured by firms experienced in manufacturing components listed under ANSI/TIA/EIA 568-B.2 and whose products conform to the standards of this specification.
- H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

## 1.5 COORDINATION

- A. Coordinate Work of this Section with Owner's telephone switch, telephone instrument, workstation, and LAN equipment suppliers. Coordinate service entrance arrangement with local exchange carrier.
  - 1. Meet jointly with representatives of above organizations and Owner's representatives to exchange information and agree on details of equipment arrangements and installation interfaces.
  - 2. Record agreements reached in meetings and distribute record to other participants.
  - 3. Adjust arrangements and locations of distribution frames, patch panels, and cross connects in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of the telephone switch and LAN equipment.
- B. Coordinate Work of this Section with the owners CCTV Surveillance System provider.
  - 1. Provide a data cable to each camera location shown on the power and signal plans, coordinate terminations with the CCTV Surveillance System provider, typically leave 15' of cabling coiled up at the camera location.
  - 2. Cables associated with CCTV Surveillance Cameras shall be terminated at the "MDF" or "IDF's" on separate patch panels from cables associated with communications outlets.
- C. Coordinate Work of this Section with the owner for wireless access points (WAPS).
  - 1. Provide two category 6A data cables (unless noted otherwise on the drawings) to each WAP location shown on the power and signal plans, coordinate terminations with the owner, typically leave 15' of cabling coiled up at the WAP location.
  - 2. Cables associated with WAP's shall be terminated at the "MDF" or "IDF's" on separate patch panels from cables associated with communications outlets or cameras.

## 1.6 MAINTENANCE/WARRANTY

- A. Provide service and maintenance of cabling system for one year from date of substantial completion.
- B. Provide a warranty for the system (including complete horizontal channels) against malfunction due to component failure or improper installation for a period of fifteen years from date of substantial completion. When notified of a malfunction, proceed to immediately correct the situation by replacement of repair, without cost to the Owner. Clearly indicate provisions of the warranty in the shop drawing submittals and maintenance manuals.
- C. Within the warranty period, the contractor shall repair or replace any defective system components within 48 hours.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Cable: 500 feet of category 6 horizontal station cable.
  - 2. Outlet and Modular Jack Assemblies: One of each type for every 25 installed, but not less than one.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cable products:
    - a. AFL.
    - b. Belden.
    - c. Berk-Tek, Inc.
    - d. CCT.
    - e. Chatsworth.
    - f. CommScope, Inc.
    - g. General Cable.
    - h. HellermannTyton.
    - i. Hitachi Cable Manchester.
    - j. Mohawk/CDT.
    - k. Optical Cable Corporation.
    - l. Corning.
    - m. Superior Essex.
    - n. Siemon Company
  - 2. Connectors, distribution racks, modular jacks, wall plates, patch panels, cable management products, etc. shall be to the greatest extent possible, of one of the following manufacturers:
    - a. AFL.
    - b. Belden.
    - c. CommScope, Inc.
    - d. Cooper B-Line
    - e. Great Lakes Case & Cabinet Company, Inc.
    - f. HellermannTyton.
    - g. Hoffman.
    - h. Hubbell Premise Wiring, Inc.
    - i. Leviton Network Solutions.
    - j. Optical Cable Corporation.
    - k. Ortronics, Inc.
    - l. Panduit Corporation, Network Systems Division.
    - m. Siemon Company.
    - n. Signamax Connectivity Systems.

3. Innerduct:
  - a. Carlon
  - b. Endot Industries
  - c. Pyramid

## 2.2 SYSTEM REQUIREMENTS

- A. General: Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.
- B. Expansion Capability: Unless otherwise indicated, all patch panels, cross connects, terminal strips, trays, wireways, equipment racks, etc. shall be sized to accommodate 20 percent future increase in active workstations.
  1. Coordinate the location of the patch panel expansion capability with the owner.

## 2.3 MOUNTING ELEMENTS

- A. Raceways and Boxes: Comply with Division 26 Section "Raceways and Boxes."
- B. Backboards: 3/4-inch (19-mm) interior-grade, fire-resistive-treated plywood.
- C. Distribution Racks: Wall-mounting, approximately 36" in height and be modular-steel units designed specifically for attachment of telecommunications terminal support equipment.
  1. Racks shall be designed to accommodate TIA/EIA standard rack mount equipment.
  2. Provide vertical (front and rear on each side of rack extending from floor to top of rack) and horizontal (2 rack space unit between each patch panel) cable management channels.

## 2.4 WIRE MANAGEMENT

- A. Jumper Troughs:
  1. Furnish and install 110 jumper troughs for management of terminal block patch cords and jumper wires, two per terminal block.
- B. Patch Cord Organizer:
  1. Furnish and install 110 patch cord organizers for management of terminal block patch cords and jumper wires, two per patch panel.
- C. Wire Distribution Spools:
  1. Furnish and install wire distribution spools for management of terminal block jumper wires, quantities as required.
- D. Wire Hanger Assembly:
  1. Furnish and install wire hanger assemblies for management of patch cables, four per backboard.

E. Cable Hangers:

1. Furnish and install “j-hook” cable hangers that are a minimum of one inch wide and be spaced no more than four feet on center.

## 2.5 COPPER CONNECTS AND TERMINAL EQUIPMENT

- A. Patch panels (data horizontal channel cable terminations data backbone cable terminations, and CCTV surveillance camera terminations) shall be modular and designed to accommodate the mounting of multiple numbered jack units. Connectors of the category 6 (6A for WAPS) IDC type, at each jack, are to be used to terminate all wires of each arriving cable. Provide a jack for every arriving cable, plus spares as elsewhere required.
1. Data cables, voice cables, and camera cables shall be each be terminated on separate patch panels.
  2. Horizontal channel cables shall be terminated on separate patch panels the backbone cables.
  3. Mounting: Rack. Mount above eye level, coordinate layouts in equipment racks with the owner (patch panel/switch/patch panel/switch, etc...)
- B. Jacks and jack assemblies for UTP cables shall be category 6 jack modules, modular, color coded, RJ45 type receptacles, with integral IDC type terminals (clips).
1. Jacks shall conform to the performance standard set for in EIA standards and shall have been tested in accordance with TIA/EIA 568-B.2 standard. Jacks shall be durable enough to withstand 2,500 (minimum) insertions and withdrawals of a mating plug, without jack failure or degradation of the connection, as defined in IEC 603-7.
- C. Patch panel patch cords shall be category 6, 4 pair cables in required lengths, not to exceed 5 meters in length, and shall be of the same manufacturer as other connectivity components in the system. Furnish as UTP and STP, as required. Plug connectors must be designed to properly mate with the jacks being installed. Provide one patch cord for every patch panel data jack in the facility.
- D. Workstation patch cords shall be category 6, 4 pair cables in 2, 3, and 4 meter lengths, and shall be of the same manufacturer as other connectivity components in the system. Furnish as UTP and STP, as required. Plug connectors must be designed to properly mate with the jacks being installed. Provide one patch cord for every communications outlet in the facility. Provide equal number of 2, 3, and 4 meter length cords.
- E. Communications outlets (as designated by a half filled/half open triangle on the drawings) shall consist of multi jack/connector assemblies mounted in single gang faceplates. Outlets shall be equal to Siemon MAX series plastic faceplates in gray finish with designation labels and covers, provide space for two couplers. Couplers shall be equal to Siemon MAX series angled coupler assemblies in gray finish (flat couplers shall be used for communications outlets located in ceilings and floor boxes). Unless noted otherwise on the plans, all communications outlets shall be equipped with a category 6 double jack coupler, equal to Siemons CT-6 series, with one data cable (1D) and a voice jack coupler, equal to Siemons CT-6 series, with one voice (1V) cable to the nearest MDF or IDF location.

1. Typical Legend: Factory label top left jack (gray), "Data"; top right jack (gray), "Data"; bottom left jack (blue), "Voice"; bottom left jack (if required) (gray, blue, or red), "Data", "Voice", or "Fax" as required for the application.
- F. Where wall mount telephone outlets are to be installed, the associated wall jack assemblies shall be of stainless steel design and utilizing binder screws to capture the wires and metal stud posts to hold the wall mount phone in place. Wall mount telephone outlets shall be provided with one voice jack matching other jacks in the facility and one associated voice cable (1V) to the nearest MDF or IDF location unless noted otherwise.

## 2.6 AUDIO-VIDEO (A/V) ROOM OUTLETS

- A. Where noted on plans with the symbol "AV", combination Audio-Video (A/V) Outlets shall be provided and installed.
1. Outlets shall be Hubbell iStation modular plates and include an various types of audio and video termination jacks, as further described herein and shown on the drawings. Refer to fabrication details found on electrical plansheets for general layout information.
  2. Cover Trim Plates shall be made of gray plastic with ID label and sized appropriately for the application.
  3. Audio / video modules shall be thermoplastic and designed specifically to front load into the cover plate.
    - a. Modules shall be Hubbell AV 110 Everywhere with IDC terminations for UTP.
    - b. Modules and any A/V insert jacks shall be finished in color gray.
- B. Each Audio Video Outlet shall be configured as follows:
1. Hubbell IMF2GY 1-gang gray frame consisting of (1) IMH110ST2GY HDMI 2 unit module (source or display end) with various sized blanks to fill in the rest of the plate.
- C. Associated Audio-Video (A/V) Hardware & Distribution Equipment
1. Under the scope of this contract NO A/V hardware (twisted pair products, amplifiers, scalers, bridgers, transmitters, receivers, etc.) are to be provided OR installed. These products are to be "Owner Provided".
  2. Under the scope of this contract NO patch cables or jumpers are to be provided OR installed. These products are to be "Owner Provided".

## 2.7 UTP/STP COPPER CABLES

- A. All data communications cables shall be listed in compliance with category 6 TIA/EIA-568-B.1 standards. Manufacturer's test results shall certify compliance with this standard.
1. Data cables shall be blue, camera cables shall be yellow.
- B. All communications (WAP) cables shall be listed in compliance with category 6A ANSI/TIA-568.2-D standards. Manufacturer's test results shall certify compliance with this standard.
1. WAP cables shall be violet.
- C. Conductors shall all be of solid copper.
- D. Unshielded Twisted Pair (UTP) Cable shall be multipair, 24 ga., color coded, thermoplastic-insulated conductors in a PVC jacket.

- E. Shielded Twisted Pair (STP) Cable shall be multipair, 24 ga., color coded, thermoplastic-insulated conductors, with overall aluminum/polyester shield with a tinned copper drain wire, with overall PVC jacket.
- F. Where required to comply with building and life safety codes, cables shall be rated for use in a Plenum environment. Features to remain as previously described, except that jacket materials are to be modified to attain the proper listing for the cable.
- G. Provide 4 pair category 6 cables for all data and voice runs to communications outlets, wall mount telephone outlets, and cameras.
- H. Category 6 UTP cable shall be provided to connect the devices within the integrated faceplate at the hi and low A/V outlet locations. (2) cables shall be used to connect the HDMI modules.
- I. Whenever cabling is routed under grade with each end of the raceway rising to finish floor elevation, cabling must be wet location listed.

## 2.8 FIBER-OPTIC CABLES, CONNECTORS, AND TERMINAL EQUIPMENT

- A. Cables: OM4, factory fabricated, jacketed, low loss, glass type, fiber optic, multimode, graded index, operating at 850 and 1300 nm, and be laser optimized with aqua jacket.
  - 1. Backbone, Strands per Cable: 6, unless otherwise indicated.
  - 2. Construction: Tight buffer
  - 3. Dimensions: 50-micrometer core diameter, 125-micrometer cladding diameter.
  - 4. Maximum Attenuation: 3.5 dB/km at 850 nm; minus 1.5 dB/km at 1300 nm.
  - 5. Minimum Modal Bandwidth: 4700 MHz/km at 850 nm; 500 MHz/km at 1300 nm.
  - 6. Rated for 10 GBPS Ethernet at 550 meters for 850 nm and 300 meters for 1300 nm.
  - 7. Operating Temperature Range: Minus 20 to plus 60 deg C.
  - 8. Whenever cabling is routed under grade with each end of the raceway rising to finish floor elevation, cabling must be rated for wet location installation.
- B. Plenum Cable: Listed for use in plenums.
- C. Cable Connectors: Quick-connect, simplex- and duplex-type LC couplers with self-centering, axial adaptor mechanisms. Insertion shall not exceed more than 0.75 dB per mated pair.
- D. Patch Panel: Modular panels housing multiple-numbered duplex cable connectors.
  - 1. Permanent Connection: Permanently connect one end of each connector module to installed cable fiber.
  - 2. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to satisfy specified expansion criteria.
  - 3. Mounting: Rack.
- E. Patch Cords: Dual fiber cables in required lengths. Provide one patch cord for every cabled jack in the facility.
  - 1. Terminations: Two duplex connectors arranged to mate with patch-panel connectors, one at each end of each fiber in cord.

## 2.9 IDENTIFICATION PRODUCTS



- A. Comply with Division 26 Section "Basic Electrical Materials and Methods" and the following:
  - 1. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.
  - 2. Machine generated labels shall likewise be applied to all faceplates, patch panels, and other locations, as appropriate.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine pathway elements intended for cable. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 CABLE APPLICATION

- A. Data Backbone Fiber Cable: 6 strand (minimum) multi-mode for runs between equipment rooms and wiring closets.
- B. Data UTP Cable for Horizontal Runs (Data and Cameras): Category 6, 4 pair minimum, to be used in runs from communications outlets to wiring closets.
- C. Data UTP Cable for Horizontal Runs (WAP's): Category 6A, 4 pair minimum, to be used in runs from communications outlets to wiring closets.

### 3.3 INSTALLATION

- A. The installation shall be in accordance with the latest requirements of the NEC, State, and Local Codes, ordinances and regulations of any other governing body having jurisdiction along with meeting BICSI standards.
- B. All equipment shall be installed in a neat and workmanlike manner and to the satisfaction of the Project Engineer.
- C. Communications outlet raceway shall consist of 4" square backbox, single gang ring, and ¾" (minimum) conduit with insulated bushing to accessible ceiling space unless noted otherwise.
- D. Wiring Method: Install wiring in raceway and cable tray (where provided) except within consoles, cabinets, desks, counters, accessible ceiling spaces, and in gypsum board partitions where "free air" cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and wiring except in unfinished spaces. All cabling routed at exposed ceiling structure in finished spaces shall be installed in raceway.
  - 1. Whether system cabling is installed in cable tray or "free air", the system cabling shall be neatly run and shall be bundled separately from all other systems cabling.

2. Where cable is run “free air”, the cable shall be rated for the intended use and shall be neatly run and supported, using acceptable means to ensure reliable installation and performance.
  - a. Install cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
  - b. Install sleeves for cable penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls. Provide insulated bushings for protection of conductors.
  - c. Secure and support cable at intervals not exceeding 4 feet and not more than 12 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - d. Utilize cable distribution rings and hangers, standoffs, spools and other suitable devices as an aid in managing all cable runs. Where cable tray is not provided, cable distribution hangers shall be wall or ceiling mounted above accessible ceilings at varying 4 to 6 foot intervals. All cable hangers shall be self supporting and be attached to building structure.
  - e. Cables shall not be laid on or draped across any ceiling tiles, grids, electrical or mechanical fixtures, raceways, piping, or ductwork. Maintain at least a 6 inch separation between the communications cables and fluorescent or HID lighting.
  - f. Cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.
  - g. Tie-wraps are not approved, where extra supports are needed for cable support, utilize Velcro strapping.
- E. Install cable using techniques, practices, and methods that are consistent with Category 6 (6A for WAPS) rating of components and that ensure category 6 (6A for WAPS) performance of completed and linked signal paths, end to end.
- F. All fiber-optic back-bone cabling shall be installed in raceway.
- G. Install cable without damaging conductors, shield, or jacket.
- H. Do not bend cable in handling or in installing to smaller radii than minimums recommended by manufacturer.
- I. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
  1. Pull cables simultaneously if more than one is being installed in the same raceway.
  2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
  3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage media or raceway.
- J. Cable Slack: Provide additional slack at both ends of cables to accommodate future cabling system changes. Include the slack length in all length calculations to ensure that horizontal cable does not exceed 295'.
  1. Do not store slack cables in bundled loops. Store cable slack in an extended loop or in a figure 8 configuration to alleviate stress.
    - a. The minimum amount of slack at the MDF and IDF locations shall be 10'.
    - b. The minimum amount of slack at communications outlet locations shall be 1'.

- K. Wiring within Wiring Closets: Provide adequate length of conductors. Train conductors to terminal points with no excess. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- L. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
- M. Use splice and tap connectors compatible with media types.

### 3.4 GROUNDING

- A. Comply with Division 26 Section "Grounding."
- B. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- C. To ensure proper grounding, a separate, green #6 copper stranded wire shall be provided & extend from the main distribution frame (MDF) to all intermediate distribution frames (IDF) and all other wiring closets back to the main electrical service entrance central ground reference location. Grounding and bonding shall conform to requirements and TIA/EIA-607 standard.
- D. A ground buss bar shall be installed in each MDF and IDF. It shall have insulated standoffs and be pre-drilled with an array of 1/4" holes. The MDF's buss bar size shall be 1/4" x 4" x 14" and the IDF bus bars shall be 1/4" x 2" x 7". All connections to the buss bars shall be made via non-reversible crimp style one or two hole connectors.

### 3.5 INSTALLATION IN EQUIPMENT ROOMS AND WIRING CLOSETS

- A. Line walls with 3/4" plywood backboards. Paint backboards with two coats of grey fire retardant paint.
- B. Mount patch panels, terminal strips, connecting hardware, and cable management equipment on backboards, unless otherwise indicated.
- C. Group connecting hardware for cables into separate logical fields.
- D. Use patch panels to terminate data cables entering the space, unless otherwise indicated.

### 3.6 IDENTIFICATION

- A. Identify system components complying with applicable requirements in Division 26 Section "Basic Electrical Materials and Methods", TIA/EIA-606 standard, and the following specifications.
- B. System: Use a unique, three-syllable alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with the same designation. Use logical and systematic designations for facility's architectural arrangement.
  - 1. First character identifies and locates wiring closet or equipment room where cable originates.

2. Second character identifies and locates cross-connect or patch-panel field in which cable terminates.
  3. Third character designates the position occupied by the cable (and its pairs) in the field.
  4. Subsequent characters to further describe the cable routing and destination, as deemed necessary.
- C. Communications Outlet: Label jacks within outlets and cables within outlet boxes.
- D. Distribution Racks and Frames: Label each unit and field within that unit.
- E. Within Connector Fields, in Wiring Closets and Equipment Rooms: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both communication and data-processing equipment, use a different color for jacks and plugs of each service.
- F. Cables, General: Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
- G. Cable Schedule: Post in prominent location in each wiring closet and equipment room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Provide electronic copy of final comprehensive schedules for Project, in software and format selected by Owner.

### 3.7 FIELD QUALITY CONTROL

- A. Testing: On installation of cable and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed.
- B. Test Reports shall be generated utilizing the compilation software provided as part of the test equipment package routinely included with current data communications test equipment.
- C. Correct malfunctioning units at the Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- D. Test Equipment Criteria:
1. All category 6 field testing shall be performed with an approved level IV UTP/ScTP field test device.
  2. All UTP/ScTP field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
  3. Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
  4. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.
- E. Copper Cable Testing:
1. Category 6 Data and Voice Cable:

- a. Category 6 UTP/ScTP horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the permanent link, and 100 m (328 ft) for the channel shall be 100% tested according to ANSI/TIA/EIA-568-B.1.
  - b. Test parameters include wire map plus ScTP shield (when present) continuity, length, NEXT loss (pair to pair), NEXT loss (power sum), ELFEXT loss (pair to pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.
  - c. All UTP/ScTP backbone cables exceeding 90 meters shall be 100% tested for continuity.
  - d. All installed channels shall perform equal to or better than the minimum requirements as specified below at the highest frequency:
    - 1) Frequency Range: 1-250MHz
    - 2) Insertion Loss: 36 dB
    - 3) NEXT Loss: 33.1 dB
    - 4) Power Sum NEXT Loss: 30.2 dB
    - 5) ELFEXT: 15.3 dB
    - 6) Power Sum ELFEXT: 12.3 dB
    - 7) Return Loss: 20.1 dB
    - 8) Propagation Delay: 546 ns
    - 9) Delay Skew: 50 ns
    - 10) ACR: -2.7 dB
    - 11) Power Sum ACR: -5.7 dB
2. Category 6A Data Cable:
- a. Category 6A UTP/ScTP horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the permanent link, and 100 m (328 ft) for the channel shall be 100% tested according to ANSI/TIA-568.2-D
  - b. Test parameters include wire map plus ScTP shield (when present) continuity, length, NEXT loss (pair to pair), NEXT loss (power sum), ELFEXT loss (pair to pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.
  - c. All UTP/ScTP backbone cables exceeding 90 meters shall be 100% tested for continuity.
  - d. All installed channels shall perform equal to or better than the minimum requirements as specified below at the highest frequency:
    - 1) Frequency Range: 1-500MHz
    - 2) Insertion Loss: 45.3 dB
    - 3) NEXT Loss: 33.8 dB
    - 4) Power Sum NEXT Loss: 31.8 dB
    - 5) ACR: -11.4 dB
    - 6) Power Sum ACR: -13.4 dB.
    - 7) ARC-F: 13.8 dB.
    - 8) PS-ACR-F: 10.8 dB.
    - 9) Return Loss: 15.2 dB.
    - 10) Propagation Delay: 536 ns

F. Fiber Optic Cable Testing:

1. Fiber optic cables shall be 100% tested for insertion loss and length.
2. Length shall be tested using an OTDR, optical length test measurement device, or sequential cable measurement markings.
3. Insertion loss shall be tested in at least one direction using the 1-jumper method.
4. Acceptable insertion loss test results shall be determined using the following calculation:

- a. Link Insertion Loss = cable attenuation + connector insertion loss + splice insertion loss
    - 1) Cable attenuation (dB) = attenuation coefficient (dB/km) x length (km).
    - 2) Connector Insertion Loss = .75dB.
    - 3) Splice Insertion Loss = .3 dB per splice.
- 5. Horizontal Fiber Testing: All installed channels shall perform equal to or better than the minimum requirements as specified below:
  - a. Maximum Insertion Loss: 1.85 dB at 850 nm, 1.7 dB at 1300 nm.
  - b. Minimum Return Loss: -45dB.
- 6. Backbone Fiber Testing: All installed channels shall perform equal to or better than the minimum requirements as determined from the above equation for the cable length installed.
  - a. Multimode Cable:
    - 1) Maximum Insertion Loss at 2 km length: 8.5 dB (+ .3 dB per splice) at 850 nm, 4.5 dB (+ .3 dB per splice) at 1300 nm.
    - 2) Minimum Return Loss: -45dB.

### 3.8 ACCEPTANCE REQUIREMENTS

- A. The contractor must warrant in writing that 100% of the installation meets the requirements specified.
- B. The owner reserves the right to conduct, using contractor equipment and labor, a random re-test of up to 5% of the cable plant to confirm documented results. Any failing cabling shall be re-tested and restored to a passing condition. In the event more than 2% of the cable plant fails during re-test, the entire cable plant shall be re-tested and restored to a passing condition at no additional cost to the owner.
- C. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation as described in this specification.

### 3.9 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

### 3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain systems.
  - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
  - 2. Train designated personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and extending wiring to establish new workstation outlets. Provide a minimum of four hours training.
  - 3. Review data in maintenance manuals. Include copies of all field tests and results. Test results shall show every termination point by identification number and list results of all

- tests performed. Identify every jack and outlet by name, cable ID, patch panel and crosspoint ID, as well as a description of the building location where the jack is located.
4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 277400

## SECTION 287210 - FIRE ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes fire alarm systems with manual stations, detectors, signal equipment, controls, and devices.
- B. Related Sections include the following:
  - 1. Division 21 for water flow devices and sprinkler valve-tamper devices.

#### 1.3 DEFINITIONS

- A. FACP: Fire alarm control panel.
- B. LED: Light-emitting diode.
- C. Definitions in NFPA 72 apply to fire alarm terms used in this Section.

#### 1.4 SYSTEM DESCRIPTION

#### 1.5 SYSTEM DESCRIPTION

- A. General: All new fire alarm devices shall be connected to the existing Siemens fire alarm system. All new field devices shall be UL listed with the existing system and shall operate in a compatible, seamless manner. Where required by applicable codes, existing and new notification devices shall be synchronized. Expand and upgrade the existing system as required for a complete operating system.
- B. General: Noncoded, addressable system with manual and automatic alarm initiation; and multiplexed signal transmission dedicated to fire alarm service only.
- C. Wiring Class and Style: Initiating device circuits and signaling line circuits shall be Class B.

#### 1.6 SUBMITTALS, SHOP DRAWINGS & MAINTENANCE MANUALS

- A. Submittals shall be provided in accordance with Division 1 and as further described herein.



- B. Submittals shall include major equipment material lists, summarizing every item to be provided, by manufacturer, part number, quantity, and include a brief summary of each item. Manufacturer's product data sheets, describing each of the major components shall also be provided.
- C. Submittals shall be tab divided to aid in identifying the various sections of the submittal.
- D. Shop drawings shall include complete floor plan drawings showing device locations, conduit routing, wire and cable quantity and sizes. Functional block diagrams, complete termination diagrams, showing all headend, control and typical field devices, shall also accompany the submittal.
  - 1. Battery: Provide battery sizing calculations for the control panel and each power expander for actual connected loads.
  - 2. Voltage Drop Calculations: Provide voltage drop calculations for all notification circuits.
  - 3. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
- E. Maintenance manuals shall be compiled in accordance with the Division 1, shall include all information provided as part of the original submittal and shall also be updated to include installation notes, manufacturer's manuals, etc. Manuals shall also include:
  - 1. Descriptions of all equipment and normal operating procedures.
  - 2. Final shop drawings, updated to reflect "as-built" accuracy. Include outlets with label ID's, and cable designations and routing information.
  - 3. Field test reports shall be provided, indicating and interpreting test results for compliance with performance requirements of the Project. Provide certificate of completion in compliance with NFPA 72.
  - 4. Maintenance data shall be included for all major pieces of equipment, as per the requirements specified in Division 1.
  - 5. Copy of major equipment manufacturer's standard warranty statements, for future reference and use, should claims need to be submitted.
- F. Submissions to Authorities Having Jurisdiction: In addition to distribution requirements for Submittals specified in Division 1 Section "Submittals", make an identical submission (quantity as required by the AHJ) to authorities having jurisdiction. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

## 1.7 QUALITY ASSURANCE

- A. Product Quality
  - 1. Equipment described in this Section shall be provided by a company regularly engaged in the design, sale and installation of Fire Alarm Systems. This company shall also have a service organization, trained by the equipment manufacturer and located a reasonable distance from the jobsite, which is capable of maintaining the system once installed. The services of this company shall be retained by the Electrical Contractor to supervise the system design, installation, make final system connections, and perform all tests and balance work required.

2. All basic electronic equipment shall be listed by Underwriter's Laboratories, Inc. for the application and shall be products of manufacturers of established reputation and experience.
  3. Obtain fire alarm system components through one source from a single manufacturer.
- B. Contractor Qualifications
1. The Installing Contractor shall be a firm specializing in the type of work called out in this specification section and shall, upon request, provide documentation that they have successfully completed at least three other installations of similar size and scope to this installation.
  2. Compliance with Local Requirements: Comply with applicable building code, local ordinances and regulations, and requirements of authorities having jurisdiction.
  3. Comply with NFPA 72.
  4. The Installing Contractor (and any Subcontractors working for the Installing Contractor) shall be licensed, in accordance with local, regional and state authorities having jurisdiction, to complete the work that they are contracted to perform.

## 1.8 SEQUENCING AND SCHEDULING

- A. Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment and restore damaged surfaces.
1. Package operational fire alarm and detection equipment that has been removed and deliver to Owner.
  2. Remove from site and legally dispose of existing material not designated for other disposition.

## 1.9 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. Strobe Units: Quantity equal to 10 percent of amount installed, but not less than one unit.
  2. Ceiling Mount Smoke Detectors and Heat Detectors: Quantity equal to 10 percent of amount of each type installed, but not less than one unit of each type.
  3. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than one unit of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Siemens.

## 2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the FACP.
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.
- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. Remote Alarms: Automatically route alarm, supervisory, and trouble signals to the Building Energy Management System or the Building Access Control and Security Management System.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke (duct type smoke detector shall result in either an alarm or a supervisory condition as required by the AHJ) or flame or heat detector, or operation of a sprinkler flow device initiates the following:
  - 1. Notification-appliance operation.
  - 2. Identification at the FACP and the remote annunciator of the device originating the alarm.
  - 3. Transmission of an alarm signal to the remote alarm receiving station.
  - 4. Transmission of an alarm signal to the Building Energy Management System or the Building Access Control and Security Management System.
  - 5. Release of fire and smoke doors held open by magnetic door holders.
  - 6. Shutdown of fans and other air-handling equipment serving zone where alarm was initiated.
  - 7. Closing of smoke dampers in air ducts of system serving zone where alarm was initiated.
  - 8. Recording of the event in the system memory.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP and the remote annunciator.
  - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.

2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
  3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- K. Sprinkler valve-tamper switch operation initiates the following:
1. A supervisory, audible, and visible "valve-tamper" signal indication at the FACP and the annunciator.
  2. Flashing of the device location-indicating light for the device that has operated.
  3. Recording of the event in the system memory.
  4. Transmission of supervisory signal to remote alarm receiving station.
- L. Removal of an alarm-initiating device or a notification appliance initiates the following:
1. A "trouble" signal indication at the FACP and the annunciator for the device or zone involved.
  2. Recording of the event in the system memory.
  3. Transmission of trouble signal to remote alarm receiving station.
- M. FACP Alphanumeric Display: Plain-English-language descriptions of alarm, supervisory, and trouble events; and addresses and locations of alarm-initiating or supervisory devices originating the report. Display monitoring actions, system and component status, system commands, programming information, and data from the system's historical memory.

## 2.3 SMOKE DETECTORS

- A. General: Include the following features:
1. Operating Voltage: 24-V dc, nominal.
  2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
  4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
  5. Sensitivity: Can be tested and adjusted in-place after installation.
  6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
- B. Photoelectric Smoke Detectors: Include the following features:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
  2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
- C. Duct Smoke Detector: Photoelectric type.
1. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size, air velocity, and installation conditions where applied.
  2. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

## 2.4 NOTIFICATION APPLIANCES

- A. Description: Equip for mounting as indicated and have screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
  - 2. Weatherproof where indicated.
  - 3. Where shown to be ceiling mounted, units shall be listed for ceiling mount application.
  - 4. Devices shall have white finish.
- B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet (3 m) from the horn.
  - 1. Horn audibility level shall be field selectable to suit conditions.
  - 2. Sleeping Rooms: Low frequency type as required by NFPA and the AHJ.
- C. Visible Alarm Devices: Xenon strobe lights listed under UL 1971 with clear or nominal white polycarbonate lens. Mount lens on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
  - 1. Rated Light Output: As noted on the plans. If candela ratings are not noted on the plans, provide devices with candela ratings as required to provide for required visual notification.
  - 2. Devices shall be synchronized as required by applicable codes.
  - 3. Strobe Leads: Factory connected to screw terminals.

## 2.5 REMOTE DEVICE LOCATION-REMOTE TEST/INDICATING LIGHTS AND IDENTIFICATION PLATES

- A. Description: Remote test station with LED indicating light and remote test key switch near each smoke detector that may not be readily visible. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp and test switch are flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector is located.

## 2.6 CENTRAL FACP

- A. Existing, upgrade as required for system expansion.

## 2.7 REMOTE ANNUNCIATOR

- A. Existing, upgrade as required for system expansion.

## 2.8 NOTIFICATION APPLIANCE CIRCUIT POWER EXTENDER PANEL

- A. Provide additional panels as required for operation of notification appliances.

1. Panel shall provide synchronization of strobes at a rate of 1Hz and operate horns with a temporal code pattern.
2. Panel shall provide the capability to silence the audible signals, while the strobes continue to flash.
3. Panel shall provide the capability to synchronize multiple notification appliance circuits.

## 2.9 EMERGENCY POWER SUPPLY

- A. General: Components include valve-regulated, recombinant lead acid battery; charger; and an automatic transfer switch.
  1. Battery Nominal Life Expectancy: 4 years, minimum.
- B. Battery Capacity: Comply with NFPA 72.
  1. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
- C. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining batteries at full charge. If batteries are fully discharged, the charger recharges them completely within four hours. Charger output is supervised as part of system power supply supervision.
- D. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

## 2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a multiplex system address for listed fire and sprinkler alarm-initiating devices with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to a elevator controller to initiate elevator recall or to a circuit-breaker shunt trip for power shutdown.

## 2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Existing, upgrade as required for system expansion.

## 2.12 WIRE

- A. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation. Sized per manufacturer requirements.
- B. Power-Limited Circuits: NFPA 70, Types FPL, FPLR, or FPLP, as recommended by manufacturer.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. The installation shall be in accordance with the latest requirements of the NEC, State, and Local Codes, ordinances and regulations of any other governing body having jurisdiction
- B. All equipment shall be installed in a neat and workmanlike manner and to the satisfaction of the Project Engineer.
- C. Provide a smoke detector at the FACP and each notification appliance circuit signal power extender panel.
- D. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.
- E. Ceiling-Mounted Smoke Detectors: Not less than 4 inches (100 mm) from a side wall to the near edge. For exposed solid-joist construction, mount detectors on the bottom of joists. On smooth ceilings, install not more than 30 feet (9 m) apart in any direction.
- F. Smoke Detectors near Air Registers: Install no closer than 36 inches.
- G. Duct Smoke Detectors: Comply with manufacturer's written instructions.
  - 1. Verify that each unit is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  - 2. Install sampling tubes so they extend the full width of the duct.
- H. Interface with Mechanical HVAC Equipment:
  - 1. Provide alarm output signals and wiring to the building automation system and all HVAC equipment motor starters and/or AFD controllers for fan shutdown upon alarm as required by the International Mechanical Code. Coordinate requirements with mechanical contractor.
- I. Wall Mounted Audible Alarm-Indicating Devices: Install with top of device not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Combine audible and visible alarms at the same location into a single unit.
- J. Wall Mounted Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and with top of device at least 6 inches (150 mm) below the ceiling.
- K. Notification Appliance Circuits: Connected appliance load shall not exceed 80% of the allowable circuit load.
- L. Remote Device Location-Remote Test/Indicating Lights and Identification Plates: Provide for each smoke detector which is not readily visible and locate in public space near the device they monitor.
- M. FACP: Mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Wiring splices shall not be made in the control panel enclosure.

### 3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in raceway and cable tray (where provided) except within consoles, cabinets, desks, counters, accessible ceiling spaces, and in gypsum board partitions where “free air” cable wiring method may be used. Use UL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and wiring except in unfinished spaces. All cabling routed at exposed ceiling structure in finished spaces shall be installed in raceway. All wiring installed underground or underslab shall be wet location listed.
1. Whether system cabling is installed in cable tray or “free air”, the system cabling shall be neatly run and shall be bundled separately from all other systems cabling.
  2. Where cable is run “free air”, the cable shall be rated for the intended use and shall be neatly run and supported, using acceptable means to ensure reliable installation and performance.
    - a. Install cable parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
    - b. Install sleeves for cable penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls. Provide insulated bushings for protection of conductors.
    - c. Secure and support cable at intervals not exceeding 8 feet and not more than 12 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
    - d. Utilize cable distribution rings and hangers, standoffs, spools and other suitable devices as an aid in managing all cable runs. Where cable tray is not provided and where 10 or more cables are routed together, cable distribution rings or hangers shall be wall or ceiling mounted above accessible ceilings at varying 4 to 6 foot intervals.
    - e. Cables shall not be laid on or draped across any ceiling tiles, grids, electrical or mechanical fixtures. Maintain at least a 12 inch separation between the communications cables and fluorescent or HID lighting.
    - f. Cables shall not be strapped, taped, or attached by any means to the exterior of any conduit or raceway as a means of support.
- B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction box covers red in non-public, un-finished spaces, and above accessible ceilings.

### 3.3 IDENTIFICATION



- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Basic Electrical Materials and Methods."

### 3.4 GROUNDING

- A. Ground cable shields and equipment according to system manufacturer's written instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common-mode returns, noise pickup, cross talk, and other impairments.
- B. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- C. Final Test Notice: Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- D. Minimum System Tests: Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
  - 1. Verify the absence of unwanted voltages between circuit conductors and ground.
  - 2. Test all conductors for short circuits using an insulation-testing device.
  - 3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
  - 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
  - 5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
  - 6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
  - 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.

8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
- E. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
- F. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.
- G. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

### 3.6 CLEANING AND ADJUSTING

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:
  1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide a minimum of 4 hours' training.
  2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
  3. Schedule training with Owner, through Architect/Engineer, with at least seven days advance notice.

END OF SECTION 287210

THIS PAGE INTENTIONALLY LEFT BLANK

# **DIVISION 01 - GENERAL REQUIREMENTS**

**SECTION 01 32 23 SURVEY AND LAYOUT DATA**

**SECTION 01 73 29 CUTTING AND PATCHING**



# SECTION 01 32 23

## SURVEY AND LAYOUT DATA

### PART 1 GENERAL

#### 1.01 GENERAL

- A. The requirements and provisions for engineering and layout of survey and layout data are as specified in the General Conditions and as supplemented herein.
- B. Topography and profiles showing existing ground elevations and culture were obtained by topographic survey.
- C. The Contractor shall hire the Engineer/Surveyor to furnish construction staking to prosecute the Work as described below. The Contractor shall make timely demands of the Engineer/Surveyor for such staking. The Contractor shall provide advance written notice of not less than three working days for setting stakes.
  - 1. Stakes showing sanitary sewer and storm sewer grade lines will be provided, at an offset as agreed to by the Contractor, at intervals of not less than 50 feet. Benchmarks for elevation will be provided in close proximity to site.
  - 2. Sewer and storm cleanouts and water curb stops will be staked.
  - 3. Concrete curb & gutter/curbing, concrete sidewalk and pavement shall be staked at 25 foot intervals and at all changes in grade or line and will include radius stakes.
  - 4. The subgrade and base course for the parking lots and other areas shall be blue topped at an interval as agreed upon between the Engineer and the Contractor.
  - 5. The contractor shall be responsible for transferring from benchmarks, grade and line stakes all distances and elevations necessary for the execution of the work.
  - 6. The Contractor may request additional staking at the Pre-Construction Conference. Should the Contractor request the setting of stakes in excess of those described above, after the Pre-Construction Conference, the Contractor shall be responsible for the extra cost, which will be prorated on the basis of the total number of stakes set.
  - 7. **Electronic files can be made available for use with a Contractor's GPS system. Contractor will be responsible for the extra cost which Helms and Associates puts into preparing these files for their use and for any additional control points set by Helms and Associates personnel.**
- D. The Contractor shall preserve all construction stakes, reference points, and other survey points. In case of their loss or destruction, the Contractor shall be liable for and charged with the cost of their replacement and of any expense resulting from their loss or disturbance. Such surveys shall constitute instruction from the Engineer, and the Contractor shall not proceed with the Work until construction stakes have been provided.

- E. Should the Owner's representative be required to reset construction stakes, the cost for such resetting will be at the then current per diem rates. The charges for such Work will be deducted from the progress payments for the Contractor for the month in which the surveying Work is done by the Owner and thereon paid to the Owner's representative.

\* \* \* END OF SECTION \* \* \*

# **SECTION 01 73 29**

## **CUTTING AND PATCHING**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general requirements of the Contract including General and Supplementary Conditions and as supplemented herein shall apply to the Work covered by this Section.

#### **1.02 SCOPE AND DESCRIPTION**

- A. This section describes the necessary coordination, materials and labor associated with cutting and patching of completed Work or connection of specified Work to existing facilities.

#### **1.03 SUBMITTALS**

- A. Prior to cutting which may affect the structural integrity of any structure, facility or portion of the project, or Work of another Contractor, or completed Work or existing facilities, the Contractor shall submit written notice to the Engineer requesting consent to proceed with the cutting. The notice shall designate the location, date and time the Work will be exposed for observation, and cutting will be initiated and completed.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. All materials for cutting and patching shall comply with the Specifications for the type of Work to be done.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Cutting (including excavating), fitting or patching of Work shall be executed as required to:
  - 1. Uncover Work to provide for installation of ill-timed Work.
  - 2. Remove and replace defective Work
  - 3. Install and properly fit specified Work in existing construction, facilities, or structures.
  - 4. Remove and replace Work not conforming to requirements of Contract-Legal Documents, Specifications, or Drawings.
  - 5. Remove samples of installed Work as specified for testing.
- B. The Work of another Contractor, Work already completed, or existing facilities shall not be cut without the consent of the Engineer.



### 3.02 INSPECTION

- A. Representatives of the Contractor, Owner, and Engineer shall, before starting Work on that portion of the project, inspect and record the existing conditions of Work, including elements subject to movement or damage during:
  - 1. Cutting and patching
  - 2. Excavating and backfilling
- B. After uncovering the Work, the Contractor and Engineer shall inspect Work and note all conditions affecting installation of new products.

### 3.03 PREPARATION

- A. The Contractor shall be responsible for providing shoring, backing and support as required to maintain structural integrity of the Work, protect other work, and provide protection from the elements.

### 3.04 PERFORMANCE

- A. The fitting and adjustment of products and material shall be executed to provide a finished installation that will comply with specified tolerances and finishes.
- B. All cutting and demolition shall be executed by methods that will prevent damage to other Work, and will provide the proper surfaces to receive installation of repairs and new Work.

## **PART 4 MEASUREMENT AND PAYMENT**

### 4.01 METHOD OF MEASUREMENT

- A. Cutting and patching is considered incidental Work with no separate measurement to be made.

### 4.02 BASIS OF PAYMENT

- A. The cost of cutting and patching to complete Work as specified and shown on the Drawings shall not be measured and paid directly but shall be considered incidental to the project as bid.

\* \* \* END OF SECTION \* \* \*

## **DIVISION 02 - EXISTING CONDITIONS**

**SECTION 02 01 00 MAINTENANCE OF EXISTING CONDITIONS**

**SECTION 02 30 00 SUBSURFACE INVESTIGATION**



# **SECTION 02 01 00**

## **MAINTENANCE OF EXISTING CONDITIONS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

#### **1.02 SCOPE**

- A. This Section describes, but is not limited to, the relationship of the Project to existing underground utilities and the Work associated with the location, adjustment, and repair of underground utilities.
- B. The information and data relative to existing underground utilities are provided to assist the Contractor with the preparation of his bid. This information should not be used by the Contractor for reference during construction of the Work.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by each Contractor as the Work proceeds. Excavation work shall be done carefully so as to avoid damaging the existing utilities and Work.
- B. Each Contractor shall provide for protection, temporary removal and replacement or relocation of obstructions as required for the performance of this Work required in these contract documents.
- C. Other obstructions not shown on the plans and requiring relocation shall be exposed by the Contractor without injury; or if injured, shall be repaired by Contractor at his expense. Removal of such obstruction or its relocation shall be made by the Contractor according to the provisions of the General Conditions.

#### **3.02 UTILITY CONTACT**

- A. Prior to Work in a specific area affecting underground utilities, the following individuals shall be notified as appropriate:
- B. All above utilities, excepting water, may be located utilizing the South Dakota One Call Notification Center:

(Locate Phone Number)      1-800-781-7474

(Admin. Phone Number)      1-800-422-1242

- C. The failure of any utility to be present for any reason, at the Pre-Construction Conference, if held, shall not relieve the Contractor of any responsibility described herein.

### 3.03 UTILITY REPAIR:

- A. When an underground utility is exposed or damaged, the Contractor shall comply with the repair requirements of the affected utility.
- B. When an underground utility is exposed, the Contractor shall compact the backfill beneath the exposed utility before completion of the backfill operation.

### 3.04 SANITARY/STORM SEWER AND WATER MAIN SEPARATION:

- A. Horizontal Separation - Sewers shall be laid at least 10 feet (3.0 m) horizontally from any existing or proposed watermain. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a watermain, provided that the watermain is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the watermain is at least 18 inches above the top of the sewer.
- B. If it is impossible to obtain proper horizontal separation as described above, both the watermain and sewer shall be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the Department and be pressure tested in accordance with AWWA standards to assure water tightness before backfilling.

### 3.05 Vertical Separation

- A. Sewers Crossing Under Watermains - The sewer shall be laid to provide a minimum of 18 inches from the top of the sewer to the bottom of the watermain. The crossing shall be arranged so the sewer joints will be equidistant and as far as possible from the watermain.
- B. Sewers Crossing Over Watermains - Either the watermain or the sewermain must be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.
- C. Special Conditions - When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, one of the following methods shall be specified:
- D. Water Pipe - The sewer shall be designed and constructed equal to water pipe and shall be pressure tested in accordance with AWWA standards prior to backfilling to assure water tightness; or;
- E. Carrier Pipe - Either the watermain or the sewermain may be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.

### 3.06 Storm Sewer Requirements:

- A. A reinforced concrete pipe (RCP) storm sewer may cross below a watermain with a separation of less than 18 inches or at any height above a watermain provided the joints on

the RCP within 10 feet of either side of the watermain are assembled with:

- B. Preformed butyl rubber sealant meeting federal specification #SS-S-210A and AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the watermain will not be required when the RCP joints are collared within the 20-foot section.
- C. An O-ring that conforms to ASTM C 443 specifications. O-rings are manufactured for concrete pipe with diameters up to 18 inches.
- D. A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.
- E. There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer forcemains. There shall be an 18-inch vertical separation at crossings as required in paragraphs B and C.

#### **PART 4 MEASUREMENT AND PAYMENT**

##### **4.01 METHOD OF MEASUREMENT**

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate measurement made.

##### **4.02 BASIS OF PAYMENT**

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate and payment to be made.

\* \* \* END OF SECTION \* \* \*



# SECTION 02 30 00

## SUBSURFACE INVESTIGATION

### **PART 1      GENERAL**

#### 1.01    RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Supplementary Conditions and the provisions of Division I, General Requirements, apply to the work specified in this section.

#### 1.02    SCOPE AND DESCRIPTION

- A. The Contractor shall accept the project site in its present condition. He shall do all clearing, demolition and relocation, excavation, filling, backfilling, and grading necessary for the construction of all structures, piping, embankments, driveways, pond piping, miscellaneous structures, and all required utility construction in accordance with these specifications and in conformity with the dimensions and finished grades as shown on the plans. Excavation shall include removal of rock, dewatering, sheeting, and shoring as necessary to provide space for the required construction procedures.
- B. Unless otherwise required, the Contractor shall return all areas disturbed by him to their original grade and seed or sod in accordance with the specifications.

#### 1.03    SOIL INFORMATION

- A. **A soils investigation was completed by Geotek Engineering of Sioux Falls, SD. The reports and any test results are available at the office of Helms & Associates, 416 Production Street North, Aberdeen, S.D. Soil boring and report (& addendum) can be sent electronically if requested (if not already included in these documents).**
- B. The samples tested are not guaranteed to be indicative of any ground except at the particular and exact location of the sample. No claim shall be made or be considered resulting from any deviations from the sample test data. This information is made available to the Contractor for his own use and is in no event considered as a part of the contract.
- C. It shall be the Contractor's responsibility to determine to his own satisfaction the location and nature of all surface and sub-surface obstacles and the soils and water conditions which will be encountered during the construction of the treatment facility associated structures and piping.
- D. Additional test borings and other exploratory operations as may be desired may be made by the Contractor at no cost to the Owner.



\* \* \* END OF SECTION \* \* \*

## **DIVISION 03 - CONCRETE**

**SECTION 03 11 00 CONCRETE FORMWORK**

**SECTION 03 15 00 CONCRETE JOINTS AND WATERSTOPS**

**SECTION 03 20 00 CONCRETE REINFORCEMENT**

**SECTION 03 30 00 CAST-IN-PLACE CONCRETE**



## **SECTION 03 11 00 CONCRETE FORMWORK**

### **PART 1      GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this section.
- B. Related Work specified elsewhere:
  - 1. Concrete Reinforcement - Section 03 20 00
  - 2. Concrete Joints and Water Stop - Section 03 15 00
  - 3. Cast-in-place Concrete - Section 03 30 00

#### **1.02    DESCRIPTION OF WORK**

- A. The extent of formwork is indicated by the concrete structures shown on the drawings.
- B. The work includes providing of the form work and shoring for cast-in-place concrete, and installation into formwork of items required such as anchor bolts, setting plates, bearing plates, anchorages, inserts, frames, nosings, and other items to be embedded in concrete (but not including reinforcing steel).

#### **1.03    QUALITY ASSURANCE**

- A. Examine the substrate and the conditions under which concrete formwork is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Codes and Standards: Unless otherwise shown or specified, design, construct, erect, maintain, and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute standard ACI 34, "Recommended Practice for Concrete Formwork."
- C. Allowable Tolerances: Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347, and as follows:
  - 1. Variation from plumb in lines and surfaces of columns, piers, walls, and arises; ¼-inch per 10-foot, but not more than 1-inch total. For exposed corner columns, control joint grooves, and other conspicuous lines, ¼-inch in any bay or 20 feet maximum; ½-inch maximum in 40 feet or more.
  - 2. Variation from level or grade in slab soffits, ceilings, beam soffits, and in arises ¼-inch in 10 feet, 3/8-inch in any bay or 20 feet maximum and ¾-inch in 40 feet or more. For exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, ¼ inch in any bay or 20 feet maximum, and ½-inch in 40 feet or more.
  - 3. Variation from position of the linear building lines and related columns, walls, and partitions, ½-inch in any bay or 20 feet maximum and 1-inch in 40 feet or more.
  - 4. Variation in sizes and locations of sleeves, floor openings, and wall openings, ¼-inch.

5. Variation in cross sectional dimensions of columns and beams and thickness of slabs and walls, minus 1/4-inch and plus 1/2-inch.
  6. Variations in footings plan dimensions, minus 1/2-inch and plus 2-inch misplacement or eccentricity, 2% of the footing width in direction of misplacement but not more than 2-inch thickness reduction, minus 5%.
  7. Variation in steps: in a flight of stairs, 1/8-inch for rise and 1/4-inch for treads; in consecutive steps, 1/16-inch for rise and 1/8-inch for treads.
- D. Before concrete placement, check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- E. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

## **PART 2      PRODUCTS**

### **2.01    FORM MATERIALS**

- A. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed, plywood-faced, or other panel type materials acceptable to Engineer to provide continuous, straight, smooth, as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Form concrete surfaces, which will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side for tight fit.
- C. Form ties shall be of removable end, permanently embedded body type and shall have sufficient strength and rigidity to support and maintain the form in proper position and alignment without the use of auxiliary spreaders. Unless otherwise shown, cones shall be provided on the outer ends of each tie and the permanently embedded portion shall be at least 1-inch back from the concrete face. Form ties for water bearing walls shall be provided with water seal washers located on the permanently embedded portions of the ties at the approximate center of the wall. Permanently embedded portions of form ties that are not provided with threaded ends shall be constructed so that the removable ends are readily broken off without damage to the concrete. The type of form ties used shall be acceptable to the Engineer. Form ties fabricated on the project site and the wire ties are not acceptable.
- D. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.
- E. Provide metal inserts for anchorage of materials or equipment to concrete construction not supplied by other trades and as required for the work.

## 2.02 FORMS FOR PAVEMENT, SIDEWALK, AND CURB & GUTTER

- A. Forms shall have a depth not less than the prescribed edge thickness of the pavement. Built up forms with horizontal joints shall not be used.
- B. When staked in place, forms shall withstand the pressure of the concrete and the impact and vibration of any equipment they are required to support, without significant springing, settlement, or lateral displacement.
- C. Bent, twisted, or broken forms and those with battered top surfaces shall be removed from the work. Repaired forms shall not be used until inspected and approved.
- D. The top face of any form shall not vary from a true plane by more than 1/8-inch in 10 feet, nor shall the contact face of a straight form vary from a true plane by more than 1/4-inch in 10 feet.
- E. Straight forms shall be metal having a thickness of not less than 1/4-inch and shall be furnished in sections not less than 10 feet in length. Each section shall have provisions for locking together the ends of abutting sections. Straight forms shall have a base width of at least eight inches with flange braces extending outward on the base at least 2/3 the height of the form.
- F. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Flexible or curved forms shall be of an acceptable design.

## 2.03 DESIGN OF FORMWORK

- A. Design, erect, support, brace, and maintain formwork so that it will safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength for that purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation, and position.
- B. Design forms and false work to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
- D. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. Provide camber in formwork as required for anticipated deflections due to weight and pressures of fresh concrete and construction loads for long span members without intermediate supports.
- E. Provide temporary openings in wall forms, column forms and at other locations necessary to permit inspection and cleanout.

- F. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- G. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- H. Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Engineer. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed.

## **PART 3      EXECUTION**

### **3.01    FORM CONSTRUCTION**

- A. Construct forms complying with ACI 347, to the exact sizes, shapes, lines, and dimensions shown and as required to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.
- B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible, consistent with project requirements.
- D. Form intersecting planes to provide true, clean cut corners, with edge grain of plywood not exposed as form for concrete.
- E. Provide openings in forms to accommodate other work, including mechanical and electrical work. Accurately place and securely support items required to be built into the forms.
- F. False work:
  - 1. Erect false work and support, brace, and maintain it to safely support vertical, lateral, and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct false work so that adjustments can be made for take-up and settlement.
  - 2. Provide wedges, jacks, or camber strips to facilitate vertical adjustments. Carefully inspect false work and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.
- G. Forms for Exposed Concrete:

1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
2. Do not use metal cover plates for patching holes or defects in forms.
3. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
4. Use extra studs, walers, and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
5. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
6. Form molding shapes, recesses, and projections with smooth finish materials, and install in forms with sealed joints to prevent displacement.

H. Corner Treatment:

1. Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise shown.
2. Form chamfers with  $\frac{3}{4}$  inch x  $\frac{3}{4}$  inch strips unless otherwise shown, accurately formed and surface to produce uniformly straight lines and tight edge joints. Extend terminal edges to the required limit and miter chamfer strips at changes in direction.
3. Unexposed corners may be formed either square or chamfered.

I. See Section 03 15 00 for treatment of control and construction joints. Locate as indicated.

J. Provide openings in concrete formwork to accommodate work of other trades, including those under separate prime contracts (if any). Size and location of openings, recesses, and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into forms.

K. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

### 3.02 FORM COATINGS

- A. Coat form contact surfaces with form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces that will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### 3.03 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of the items to be attached thereto.



- B. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

### 3.04 REMOVAL OF FORMS

- A. Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work that may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations and provided that curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements may not be removed in less than 14 days and not until concrete has attained design minimum 28-day compressive strength.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

### 3.05 RE-USE OF FORMS

- A. Cleaned and repaired surfaces of forms may be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

\* \* \* END OF SECTION \* \* \*

## **SECTION 03 15 00 CONCRETE JOINTS AND WATERSTOPS**

### **PART 1      GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions, apply to the work specified in this section.
- B. Related Work Described Elsewhere:
  - 1. Concrete Formwork: 03 11 00
  - 2. Concrete Reinforcement: 03 20 00
  - 3. Cast-in-place Concrete: 03 30 00

#### **1.02    DESCRIPTION OF WORK**

- A. The extent of each type of concrete joint and waterstop required on foundation walls is shown on the drawings.

#### **1.03    SUBMITTALS**

- A. Manufacturer's catalog data and installation instructions.
- B. Certificate of compliance that waterstops meet or exceed physical property requirements of referenced specification.

### **PART 2      PRODUCTS**

#### **2.01    PREFORMED EXPANSION JOINT FILLER**

- A. Preformed, non-extruding-type joint filler constructed of closed cell polyethylene foam of firm texture. Conform to ASTM D1752, Sections 3.1 to 3.4.

#### **2.02    WATERSTOP**

- A. Waterstop shall be extruded from virgin elastomeric PVC compound, resistant to chemical action with Portland cement, alkalis, acids, and fungi. Waterstop shall conform to Corps of Engineers CRD-C 572 and the following physical characteristics:

##### **Physical Property Value Test Method**

##### **Sheet Material:**

Tensile Strength, 2,100 psi ASTM D 412

Ultimate Elongation, 360 % ASTM D 412

Low Temperature Brittleness, -35 deg. F max ASTM D 746

Stiffness in Flexure, 750 psi min ASTM D 747

##### **Finished Waterstop:**

Tensile Strength, unaged 1750 psi min ASTM D412

Durometer Shore Hardness  $70 \pm 5$  ASTM D1706

Ultimate Elongation, unaged 350% ASTM D412

- B. All waterstop shall be No 6380 as manufactured by W.R. Meadows, Serviced/Durajoint Type No. 5 as manufactured by W.R. Grace and company, or approved equal.

## 2.03 JOINT MATERIAL

- A. All joint material in contact with potable water shall meet requirements of the SD Dept of Environment & Natural Resources and be safe for use with a drinking water supply.
- B. The backer rod shall be a non-moisture absorbing, resilient material approximately 25 percent larger in diameter than the width of the joint to be sealed. The backer rod shall be compatible with the sealant and no bond or reaction shall occur between the rod and the sealant.
- C. Hot Poured Elastic Joint Sealer: The sealant shall conform to the requirements of ASTM D3405. The manufacturer shall furnish a certificate of compliance for the material.
- D. Low Modulus Silicone Sealant: Low modulus silicone sealant shall be furnished in a one-part silicone formulation. The sealant must meet the following requirements:

TEST	LIMIT	TEST METHOD
Tack Free Time	20-75 minutes	MIL S 8802
Specific Gravity	1.010-1.515	ASTM D792 (Method A)
Durometer Hardness Type A: [Cured 7 days at $77^{\circ}\text{F} \pm 3^{\circ}$ ( $25^{\circ}\text{C} \pm 2^{\circ}$ ) and 45% to 55% R.H.]	10-25 $0^{\circ}\text{F}$ ( $-18^{\circ}\text{C}$ )	ASTM D2240
Tensile Stress: [at 150% elongation, 7 day (Die C) cure at $77^{\circ}\text{F} \pm 3^{\circ}$ ( $25^{\circ}\text{C} \pm 2^{\circ}$ ) and 45-55% R.H.]	45-psi (310 kPa) max.	ASTM D412
Elongation: [7 day cure at $77^{\circ}\text{F} \pm 3^{\circ}$ □ ( $25^{\circ}\text{C}$ (Die C) $\pm 2^{\circ}$ ) & 45-55 R.H.]	1000% min.	ASTM D412
Shelf Life	6 month minimum from date of manufacture	
Ozone & Ultra Violet Resistance	No chalking, cracking or bond loss after 5000 hrs.	

TEST	LIMIT	TEST METHOD
Movement capability and adhesion [7 day cure in air 77° F $\pm$ 3° (25° C $\pm$ 2°)]	No adhesive or cohesive failure, * all 3 specimens must exceed 500% extension at 0° F (-18° C)	
Bond to Concrete Mortar Concrete briquettes [air cured 7 days at 77°F $\pm$ 3° □ (25° C $\pm$ 2°)]	50 psi (345 kPa) min. 0° F (-18°C)	AASHTO T132**

\* Prepare the specimens using 1" x 2" x 3" (25 mm x 50 mm x 75 mm) concrete blocks made in accordance with ASTM D3407. A sawed face shall be used for bond surface. Seal two inches (50 mm) of block leaving ½ inch (13 mm) on each end of specimen unsealed. The depth of sealant shall be 3/8-inch (10 mm) and the width ½-inch (13 mm). Subject the sealant to movement at a rate of two inches (50 mm) per minute until failure.

\*\* Briquettes molded in accordance with AASHTO T132 sawed in half and bonded with approximately 10 mils (0.25 mm) of sealant and tested using clips meeting AASHTO T132. Briquettes shall be dried to constant weight in oven 100°C  $\pm$ 5°. They shall be tested in tension at a loading rate of 0.3 inches (7.6 mm) per minute.

## **PART 3 EXECUTION**

### **3.01 CONSTRUCTION JOINTS**

- A. Place construction joints only where shown. In case of a breakdown in concrete placement, form the resulting unscheduled joint in the same orientation as the joints shown on the drawings for similar portions of the structure and include the key, waterstop, and additional reinforcing as may be required for the design function of the structure.
- B. After the concrete has hardened on one side of a construction joint and before placing the next concrete pour, remove the surface laitance and clean exposed surface by dry sandblasting. The sand blasted, roughened joint shall leave sound, exposed aggregate with a surface roughness of 0.2-inch  $\pm$  0.1-inch. Just prior to placing the new concrete, coat the horizontal construction joint with a 2-inch layer of cement mortar and spread uniformly and work into all irregularities of the surface. Use cement mortar of the same mixture as the structural concrete but with the coarse aggregate omitted. The mortar shall not exceed the water-cement ratio of the concrete to be placed on it and the consistency shall be suitable for placing and working. Wet the vertical surface to be joined at a construction joint and use additional spading and vibrating to prevent voids.
- C. Key construction joints unless otherwise shown. Form keyways with beveled strips or boards placed at right angles to the direction of shear. Make keyways at least 1.5 inch in depth over at least 25% of the area of the section. When necessary to make a joint because of a breakdown or emergency, place reinforcing dowels across the joint. Embed dowels 40 bar diameters on each side of the joint. Match reinforcing in size and number.
- D. Provide isolation joints in slabs on ground at all points of contact between slabs on ground and vertical surfaces such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

### 3.02 JOINTS WITH JOINT SEALANT

- A. On structures or surfaces, which require joint sealant, do not remove the material for forming the groove in the concrete until the concrete is cured. Upon removing the groove form, sandblast the groove, allow it to dry, then place the primer, backup rod, and sealant into the clean groove in accordance with the manufacturer's recommendations. Prior to sealant application, the manufacturer's representative shall demonstrate joint preparation, priming, and sealant materials for the personnel performing joint work. Groove form material shall be installed prior to concrete placement.
- B. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints. Construction joints in water holding structures shall be provided with a half inch beveled notch on the inside surface provided for caulking the joints.

### 3.03 CONCRETE PAVEMENT JOINTS

- A. Immediately after sawing the joints to their final configuration, the resulting slurry shall be completely removed from the joint and the immediate area by flushing with a jet of water and other tools as necessary. Curing membrane damaged or protective cover removed during the sawing operation shall be repaired or replaced by the Contractor as directed by the Engineer at no cost to the Owner.
- B. Longitudinal Sawed Joints: Deformed steel tie bars shall be placed perpendicular to the longitudinal joints by approved methods. Tie bars shall not be painted or coated with asphalt or other material, or enclosed in tubes or sleeves. Longitudinal sawed joints shall be cut to the dimensions specified. Suitable guidelines or devices shall be used to assure cutting the joint to a true line. The joint shall be cured a minimum of 24 hours before sawing. The sawed joint will not require reapplication of curing compound. The joint shall be sealed as required in Section 03 15 00.
- C. Longitudinal Construction Joints: When adjacent lanes of pavement are constructed separately, a keyway shall be formed along the construction joint. When deformed steel tie bars are required, they may be bent at right angles for the first lane constructed and straightened into final position before the concrete of the adjacent lane is placed. Tie bars shall conform to Section 03 15 00, except that rail steel shall not be used for tie bars that are to be bent and restraightened. The longitudinal construction joint shall be sawed shortly after the end of the curing period and shall be sealed as required in Section 03 15 00.
- D. Transverse Contraction Joints: Transverse contraction joints shall be created by sawing. Sawing shall commence when the concrete has hardened sufficiently to permit sawing without raveling. Joints shall be sawed before uncontrolled shrinkage cracking takes place. If necessary, the sawing operations shall be carried on both day and night, regardless of weather conditions. The sawed joint will not require reapplication of curing compound.
- E. The sawing of a joint shall be omitted if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw. Any procedure which results in premature and uncontrolled cracking shall be revised immediately by adjusting the sequence of cutting the joints or the time interval involved between the placing of the concrete or removal of curing media and the cutting of joints.

- F. Repair or correction of uncontrolled cracks shall be as directed by the Engineer and at the expense of the Contractor.
- G. Longitudinal random cracks penetrating the full depth of the pavement shall be grooved and sealed. The top of the crack shall be grooved to a minimum depth of 3/4 inch (20 mm) and to a width of not less than 3/8 inch (10 mm) nor more than 5/8 inch (16 mm) by means of a router. The router shall be capable of following the path of the crack and widening the top of the crack to the required dimensions without spalling or damaging the concrete. Loose and fractured concrete shall be removed and the groove shall be thoroughly cleaned and sealed.
- H. For PCC Pavement with no load transfer across the contraction joint (dowel bar assemblies are not required), the following shall apply:
  - 1. When a transverse random crack terminates in or crosses a transverse contraction joint, the uncracked portion of the joint shall be filled with epoxy-resin mortar and the crack shall be routed and sealed in accordance with Section 03 15 00.
  - 2. Where a transverse random crack parallels the planned contraction joint and is within a distance of five feet (1.5 meters) from the contraction joint in the pavement, the crack shall be routed and sealed in accordance with Section 03 15 00, and the joint shall be filled with epoxy resin mortar.
  - 3. When a transverse random crack is more than five feet (1.5 meters) from the nearest contraction joint in the pavement, the joint and the crack shall be sealed in accordance with Section 03 15 00. Joints to be filled with epoxy resin mortar shall be thoroughly cleaned.
- I. For PCC Pavement with load transfer across the contraction joint (dowel bar assemblies are required), the following shall apply:
  - 1. When a transverse random crack parallels the planned contraction joint and is more than five feet (1.5 meters) from the contraction joint, the crack shall be routed, the backer rod installed, and sealed with silicone according to Section 03 15 00.
  - 2. When a transverse random crack parallels the planned contraction joint and is less than five feet (1.5 meters) from the contraction joint, the pavement shall be sawed full depth, removed, and replaced. Load transfer across the contraction joint shall be re-established.
  - 3. When a transverse random crack intersects or parallels a planned transverse contraction joint and is less than four inches (100 mm) from the planned contraction joint for more than 50 percent of the lane width, the crack shall be routed, the backer rod installed, and sealed with silicone in accordance with Section 03 15 00.
  - 4. When a transverse random crack intersects or parallels a planned transverse contraction joint and is more than four inches (100 mm) from the planned contraction joint for more than 50 percent of the lane width, the pavement shall be sawed full depth, removed, and replaced. Load transfer across the contraction joint shall be re-established.

### 3.04 SEALING CONCRETE PAVEMENT

- A. Joints shall be sealed with hot-poured elastic joint sealer or low modulus silicone sealant as specified. Joints shall be sealed immediately after completion of the curing period, before the pavement is opened to traffic.

- B. Joint grooves with spalls greater than ½ inch (13 mm) in depth shall be patched with an approved epoxy mortar. All loose concrete shall be removed from the spalled area and the spalled surface shall be thoroughly cleaned. After cleaning, the spalled surface shall be primed and an epoxy mortar of troweling consistency shall be placed in the spalled area and finished as the original pavement surface. The epoxy binder components shall be proportioned and mixed as recommended by the manufacturer. After the epoxy binder is thoroughly mixed, dry silica sand shall be blended into the mixture to give an epoxy mortar of trowelable consistency.
- C. After the epoxy mortar has cured, the forming material shall be carefully removed. The finished joint shall have vertical faces and the joint width shall be maintained. Patching of spalls shall be done only when the temperature of the air and pavement are above 50EF (10EC).
- D. Joints to be sealed shall be thoroughly clean and dry. All materials such as old sealant, oil, asphalt, curing compound, paint, rust, and other foreign materials shall be completely removed. Cleaning shall be accomplished by sand blasting and other tools as necessary.
- E. Just prior to sealing, each joint shall be blown out using a jet of compressed air, at a working pressure of not less than 90 psi (620 kPa), to remove all traces of dust. Air compressors used for cleaning joints shall be equipped with traps capable of removing all free water and oil from the compressed air.
- F. Joint sealer application will not be permitted when the air or pavement temperature near the joint is less than 40EF (5EC) or is 40EF (5EC) and falling.
- G. The sealant shall be applied without spilling on the exposed surface. Sealant on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned. Failure of the joint material in either adhesion or cohesion will be cause for rejection. Repair shall be at the expense of the Contractor.
- H. Hot-Poured Elastic Joint Sealer: Hot-poured elastic joint sealer shall be stirred during heating so that localized overheating does not occur. All joints shall be sealed with an approved pressure-sealing device, equipped with a nozzle inserted into the joint, so sealing material will be forced from the bottom of the joint to the top.
- I. Silicone Sealant: Silicone sealant shall be applied with a mechanical device equipped with a nozzle or spout shaped to fit into the joint. The joint sealant shall be applied under pressure from the inside of the joint to remove entrapped air and ensure good joint contact.
  - 1. Backer rod shall be installed to the proper depth to produce the width and depth of sealant specified.
  - 2. The sealant surface shall be tooled to produce a slightly concave surface ¼-inch (6 mm) below the pavement surface. Tooling shall be accomplished before a skin forms on the sealant surface. The use of soap or oil as a tooling aid will not be permitted.
- J. Seasonal Restrictions:
  - 1. Silicone sealing operations shall be suspended after October 15, unless the Contractor has received written permission from the Engineer to continue sealing. After the October 15 seasonal restriction, only the initial cut shall be performed at all joints. Then the

following spring the joints shall be widened, backer rod installed, and sealed with silicone according to Section 03 15 00.

2. All costs related to the seasonal sealing restrictions including additional labor and materials, equipment, traffic control, mobilization, and incidentals shall be at the expense of the Contractor.

### 3.05 WATERSTOP

- A. Install waterstops at construction and expansion joints in structures, which will contain liquid or resist the entry of ground water. Construct forms to prevent injury to waterstops. Position and secure with wire ties, continuous bars, and rings. Heat weld splices and junctions of waterstop to form a continuous water seal. Use the heat welding equipment and temperature recommended by the waterstop manufacturer.

\* \* \* END OF SECTION \* \* \*





## **SECTION 03 20 00 CONCRETE REINFORCEMENT**

### **PART 1      GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the contract, including general and Supplementary Conditions, apply to the work specified in this section.

#### **1.02    DESCRIPTION OF WORK**

- A. The extent of concrete reinforcement is shown on the drawings and in schedules.
- B. The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties, and supports.

#### **1.03    QUALITY ASSURANCE**

- A. Examine the substrate and the conditions under which concrete reinforcement is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Codes and Standards: Comply with requirements of the following codes and standards, except as herein modified.
  - 1. American Concrete Institute, ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
  - 2. American Concrete Institute, ACI 318, "Building Code Requirements for Reinforced Concrete."
  - 3. American Welding Society, AWS D12.1 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction."
  - 4. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

#### **1.04    SUBMITTALS**

- A. For information only, submit 2 copies of steel producer's mill test certificates identifying chemical and physical analysis of each type of reinforcing steel delivered.
- B. Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315 "Manual of Standard Practice for Detailing Concrete Structures," show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

#### **1.05    PRODUCT DELIVERY, HANDLING, AND STORAGE**

- A. Deliver reinforcement to the project site bundled, tagged, and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

- B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

## **PART 2      PRODUCTS**

### **2.01    MATERIALS**

- A. Reinforcing Bars shall conform to ASTM A615, Grade 60, except as otherwise indicated.
- B. Steel Wire shall be plain wire conforming to ASTM A82.
- C. Welded Wire Fabric shall be of the gauge and mesh size as shown conforming to ASTM A185.
- D. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place shall be as follows:
  - 1. For bar supports, use CRSI Class C, plastic protected or Class E, stainless steel protected.
  - 2. For slabs on grade, use supports with sand plates or horizontal runners where wetted base materials will not support chair legs.
  - 3. Over waterproof membranes, use precast concrete chairs to prevent penetration of the membrane.

### **2.02    FABRICATION**

- A. Shop-fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials shall be defined as reinforcement with any of the following defects and will not be permitted in the work:
  - 1. Bar lengths, depths, and bends exceeding specified tolerances.
  - 2. Bends or kinks not indicated on drawings or on the final shop drawings.
  - 3. Bars with reduced cross section due to excessive rusting or other cause.

## **PART 3      EXECUTION**

### **3.01    INSTALLATION**

- A. Unless shown otherwise on drawings, comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.
- B. If the cover depth is not specifically indicated on the plan sheets, the reinforcing steel shall be protected by a minimum thickness of concrete as follows:
  - 1. Concrete against ground or exposed to water - 3" cover
  - 2. Concrete exposed to weather - 2" cover
  - 3. Beams and columns - 1 ½ " cover

4. Slabs on grade or exposed to weather - 1" cover
- C. Clean reinforcement to remove loose rust and mill scale, earth, ice and other materials, which reduce or destroy bond with concrete.
  - D. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
  - E. Unless shown otherwise on drawings, place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16-gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that ends are directed away from exposed concrete surfaces.
  - F. Install welded wire fabric in as long lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with 16-gage wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.
  - G. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
  - H. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars except as shown on drawings.

\* \* \* END OF SECTION \* \* \*



## **SECTION 03 30 00 CAST-IN-PLACE SITE CONCRETE**

### **PART 1      GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work of this section.
- B. Related Work Specified Elsewhere:
  - 1. Concrete Formwork, Section 03 11 00
  - 2. Concrete Reinforcement, Section 03 20 00

#### **1.02    DESCRIPTION OF WORK**

- A. The extent of cast-in-place concrete work is shown on the drawings.
- B. The work includes providing cast-in-place concrete consisting of Portland cement, fine and coarse aggregate, water and selected admixtures; combined, mixed, transported, placed, finished and cured as herein specified.

#### **1.03    QUALITY CONTROL AND TESTING**

- A. Prior to any concrete work, the Contractor shall obtain from his concrete supplier a certificate stating the design mix used by the supplier will meet or exceed the requirements of the specifications for Class A concrete as herein specified.
- B. The Contractor is responsible for controlling the quality of his product and shall make as many tests as necessary to satisfy himself and the Owner that his product meets or exceeds all specifications contained herein. The Contractor shall employ an independent professional testing laboratory experienced in the testing of concrete materials and mixes to perform material evaluation tests and to test concrete test cylinders. The testing agency shall meet the requirements of ASTM 329. The selection of the testing laboratory shall be subject to the Owner's and Engineer's acceptance. All such tests shall be at the expense of the Contractor.
- C. In addition to the Contractor quality control, the Engineer will perform temperature, slump, air, and compressive strength testing for the determination of product acceptance. The Engineer will cast a set of 4 standard 6-inch diameter cylinders for each 10 to 50 cubic yards of concrete placed or portion thereof and care for them as set forth in ASTM C31. These specimens shall be used to determine compressive strength requirements of the product. The results of these tests shall not relieve the Contractor of his responsibility to meet specifications contained herein.
- D. The right is reserved by the Owner to order additional checking of concrete strength by use of a Swiss hammer or by boring. Testing of this nature shall be done in the presence of the Engineer at the expense of the Contractor and may be submitted to an independent testing laboratory mutually agreed upon by the Contractor, Engineer, and Owner.

#### **1.04    SUBMITTALS**

- A. The certificate from the concrete supplier as specified above shall be submitted to the Engineer.
- B. The results of all concrete cylinder tests made shall be submitted to the Engineer.
- C. Copies of the delivery tickets for each load of concrete delivered to the site shall be furnished to the Engineer at the time of delivery.

## **PART 2      PRODUCTS**

### **2.01    CONCRETE MATERIALS**

- A. Water shall be clean and free of deleterious amounts of oils, acids, alkali, organics, silt, mud, grass, or other foreign material.
- B. Portland cement used shall meet the requirements of ASTM C150, Type II, for all usages. Only one brand of cement shall be used throughout the project unless otherwise accepted by the Engineer.
- C. Fly ash shall conform to AASHTO M 295 Class F including the optional requirements in the referenced AASHTO specification except as modified by the following:
  - Loss on ignition 2.0% Max.
  - Moisture content 2.0% Max.
  - Available alkalis as Na<sub>2</sub>O 1.5% Max. \*

\* Available alkalis up to 2.0 percent may be used, provided mortar expansion test results at 14 days is less than or equal to that of the control sample. The expansion test shall be run in accordance with modified ASTM C 441. The control sample shall be made using cement that will be used on the project. The test sample shall be made using cement and fly ash that will be used on the project.
- D. Fly ash shall be from approved base loaded electric generating plants using a single coal source. Plants using a limestone injection process for controlling air pollutants are not acceptable. Fly ash from the start up and shut down of the plant shall not be used.
- E. Fine aggregate shall be clean, sharp, natural, uncoated sand free from silt, loam, and clay, dune sand, bank run sand and manufactured sand are not acceptable. Fine aggregate shall conform to ASTM C33, fine aggregate sections.
- F. Coarse aggregate shall be clean, uncoated crushed stone or gravel conforming to ASTM C33. Clay and shale particles shall not exceed 1%. Maximum size aggregate allowed is 1/5 of narrowest dimensions between forms of the concrete member or 3/4 of minimum clear spacing between reinforcing bars. For cement finish use 1/8 inch minimum and 3/8-inch maximum size aggregate.
- G. Aggregates containing soluble salts or other substances such as iron sulphides, pyrite, marcasite, or ochre, which can cause strains on exposed surfaces, will not be allowed.
- H. If noted on the plans, fiber mesh reinforcing shall be used with all concrete sidewalk and pavement. The fiber mesh shall be added at the rate of 1 bag per cubic yard or as otherwise recommended by the manufacturer. The fiber shall be added directly to the truck at the time of mixing.

## 2.02 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures, which have not been incorporated and tested in the accepted mixes unless otherwise authorized in writing by the Engineer. All admixtures shall meet standards as specified herein.
- B. Air-entraining Admixtures shall conform to ASTM C260 and shall be equal to Grace "Darex AEA," Master Builders "MB-VR"; or Sika Chemicals "AER."
- C. Calcium Chloride: Do not use calcium chloride in concrete unless otherwise authorized in writing by the Engineer.

## 2.03 CONCRETE CLASS

- A. Classes of concrete:

CLASS OF CONCRETE	REQ. MIN. STRENGTH @ 28 DAYS (PSI)	MAX. WATER CONTENT GAL./94 LB. BAG
A	4,000	6.0

- 1. Class A concrete shall be used for all cast-in-place concrete. Minimum cement content for Class A concrete shall be 564 lbs. It may be used for all concrete requirements.

- B. Grout and Topping:

- 1. Plain grout for channel bottoms; tank bottoms where required shall be proportioned as follows:

CONSTITUENT	BY VOLUME
Type II Portland Cement	1 Part
Sand	2 Parts
¼ " Aggregate	1 ½ Parts

- 2. Non-shrinking grout shall be Embeco, Pour-Rok, or approved equal.

## 2.04 CONSISTENCY

- A. Consistency required for each pour shall be established in advance by the Contractor in cooperation with the Engineer in accordance with ASTM C143 and according to the following slump ranges:



TYPE OF CONSTRUCTION	SLUMP	AIR
Sidewalk	1" - 4 ½"	5% - 7.5%
Curb & Gutter	1" - 4 ½"	5% - 7.5%
Pavement (Formed)	1" - 4 ½"	5% - 7.5%
Pavement (Slipformed)	≤ 2"	5% - 7.5%
Miscellaneous	1" - 4 ½"	5% - 7.5%

- B. Concrete shall be of consistency as to insure the required workability and result in compacted masses having dense, uniform surfaces. In general, the consistency of concrete mixture shall be such that:
1. The mortar will cling to the coarse aggregate.
  2. The aggregates will not segregate in the concrete.
  3. The concrete when dropped directly from the discharge chute of the mixer will flatten out at the center of the pile, but the edges of the pile will stand and not flow.
  4. The concrete and mortar will show no free water when removed from the mixer.
  5. The concrete will slide and not flow into place when transported in metal chutes at an angle of 30 degrees with the horizontal.
  6. The surface of the finished concrete will be free from a surface film of "laitance."
- C. Any concrete mix failing to meet the above outlined consistency requirements, although meeting the slump requirements, will be considered unsatisfactory; and the mix shall be changed to correct such unsatisfactory conditions.

## 2.05 PROPORTIONING OF MATERIALS

- A. The proper proportioning of aggregates and cement will be determined by the Contractor and the professional testing laboratory. The proportioning of aggregates will be the most suitable combination of aggregates, which will give the necessary workability and desired consistency when mixed with water and cement as specified.
- B. The ratio of cement to dry, fine aggregate shall be that necessary to provide the maximum density of the mixture when used with the minimum amount of water required to produce the specified slump in the resulting concrete. This determination of the proper ratio shall be made by a testing laboratory at the expense of the Contractor, using representative samples of the aggregates, which will be used. Laboratory recommendations shall be submitted to the Engineer.
- C. The batch proportions used shall be such that full bags of cement are used in each batch.

- D. Fly ash may be substituted for cement in concrete. The addition or deletion of fly ash from the mix will be at no cost to the Owner. If fly ash is used, the minimum amount of cement to be replaced is 15 percent and the maximum amount is 20 percent by weight.

## 2.06 EXPANSION JOINT MATERIAL

- A. Expansion joint material shall be pre-molded, non-extruding asphalt impregnated joint filler conforming to ASTM D1751 unless shown otherwise on the plans. Joint material shall be full depth of slab or joint and unless otherwise indicated ½-inch thick.

## 2.07 FIBER REINFORCEMENT

- A. Synthetic Fiber Reinforcement.

1. Material: 100 percent virgin homopolymer polypropylene multifilament fibers, containing no reprocessed olefin materials.
2. Conformance: ASTM C 1116, Type III.
3. Fire Classifications:
  - a. UL Report File No. R8534-11.
  - b. Southwest Certification Services (SWCS), Omega Point Laboratories No. 8662-1.
4. Fiber Length: Single-cut lengths.
5. Alkali Resistance: Alkali proof.
6. Absorption: Nil.
7. Specific Gravity: 0.91.
8. Melt Point: 324 degrees F (162 degrees C).

# **PART 3 EXECUTION**

## 3.01 STORAGE OF MATERIALS

- A. Cement shall be stored in well ventilated, weatherproof buildings, which will protect the cement from dampness. The floor supporting the cement shall clear the ground a sufficient distance to prevent the absorption of moisture by the cement. The Engineer may permit small quantities of cement to be stored in the open for short periods of time (maximum of 48 hours) if a raised storage platform and adequate waterproof covering are provided. Lumpy or partially set cement shall not be used, and such cement shall be removed from the premises.
- B. The handling and storage of concrete aggregate shall be such as to prevent the admixture of foreign materials. If the aggregates are stored on the ground, sites for stockpiles shall be grubbed, cleared of all weeds and grass and leveled off. The bottom layer of aggregate shall not be disturbed or used without cleaning. Unless otherwise authorized by the Engineer, all fine aggregate shall be stockpiled at least 24 hours to reduce the free moisture content.

## 3.02 MIXING CONDITIONS

- A. The concrete shall be mixed in quantities required for immediate use, and any concrete, which is not in place within 30 minutes after being discharged from the mixer, shall not be used. Retempering of concrete will not be permitted.

- B. Where work has been started and changes in weather conditions require protective measures to be used, the Contractor shall furnish adequate shelter to protect the concrete against damage from rainfall or damage due to freezing temperatures. In case it is necessary to continue mixing operations during rainfall, the Contractor shall provide protective coverings for the material stockpiles as well as for the concrete being placed. The covering for aggregate stockpiles will be required only to the extent as may be necessary to control the moisture conditions in the aggregates so that adequate control of the consistency of the concrete mix may be maintained.
- C. No concrete shall be mixed without the approval of the Engineer when the air temperature is at or below 40° F (taken in the shade away from artificial heat) and falling. If authorized by the Engineer, concrete may be mixed when the air temperature is at 35° F and rising. When permission is given for mixing when the temperature is below 40° F, the following requirements shall govern:
1. Water used for mixing shall be heated either by steam or by dry heat to a temperature of at least 70° F but not over 150° F.
  2. Aggregates shall be heated either by steam or by dry heat to a temperature of at least 70° F but not over 150° F.
  3. The heating apparatus shall be such as to heat the mass of aggregates uniformly and preclude the occurrence of hot spots, which will burn the material. Temperature of mixed concrete shall be not less than 60° F at the time of placing in forms. After the concrete has been placed, the Contractor shall provide sufficient protection such as cover, canvas, framework, heating apparatus, etc., to enclose and protect the structure and maintain the temperature of the mix at not less than 50° F until at least 60% of the designed strength has been attained.
  4. The use of an accelerating agent in lieu of proper cold weather protection will not be authorized. In hot weather suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided.
  5. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperatures shall be less than 90° F.

### 3.03 CONCRETE PLACEMENT

- A. Before placing concrete, the Contractor shall see that bottoms of excavations are undisturbed earth, properly leveled off and tamped free of foreign materials. Forms shall be oiled or wetted prior to placing concrete. Water shall be removed from the excavation before any concrete is deposited.
- B. The concrete shall be placed in the structure immediately after mixing. Concrete shall be placed in continuous horizontal layers approximately 12-inch in thickness. Not more than 1 hour shall elapse between the placing of successive layers of concrete in any portion of the structure included in a monolithic placement. Special care must be used to thoroughly surround all reinforcement with concrete and to leave no air space or other void in this work. All concrete shall be well vibrated into all areas of forms.

- C. No concrete shall be used after its initial set has taken place, and no retempered concrete will be allowed under any circumstances or conditions.
- D. Concrete handling from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit shall be completed as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.
- E. Mechanical equipment for conveying concrete shall be provided to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice, and other deleterious materials.

### 3.04 CONSTRUCTION JOINTS

- A. Construction joints shall be made at the locations indicated on the plans or at such other locations as designated by the Engineer. In no case shall vertical joints be made in walls at or near corners. Proper bonding shall be obtained in accordance with the above specifications and the CRSI.
- B. Keys shall be provided in all joints where required to provide for either shear or water tightness. The width of the keys shall be approximately  $\frac{1}{2}$  the thickness of the section at that point, and they shall be  $\frac{1}{2}$  as deep as they are wide unless otherwise specified.
- C. All concrete shall be deposited in forms at such rate that the forms will be filled at any point with a vertical rise of concrete surface of not less than 2 feet per hour. Where necessary, the forms shall be bulk headed off and construction joint made to provide a form, which will be filled at the above specified rate. The location of these construction joints shall be approved by the Engineer.
- D. If any concrete is allowed to stand at any elevation below the finished grade or top surface for more than 2 hours without fresh concrete being applied thereon, the top surface shall be considered a construction joint and shall be constructed in accordance with these specifications and provided with keys and water sealing strips.
- E. Where practicable, vertical construction joints shall make a slight angle with the vertical, not to exceed  $\frac{1}{2}$ -inch per foot, in such manner that the freshly deposited concrete will overhang the hardened concrete, allowing the new concrete to settle upon the old during the process of hardening.

### 3.05 PROTECTING AND CURING

- A. All concrete, regardless of temperature, weather, or season, shall be protected from premature drying. Surface cracking shall be a cause for rejection, removal, and replacement. Any concrete poured during freezing or hot weather conditions shall be protected. No salts or other non-freezing materials shall be used. All fresh concrete shall be protected from open rain. All concrete shall be kept damp for at least 6 days after pouring. Membrane curing may be used. Membrane curing compound if used shall be a resin base type approved by the Engineer. Curing will not be required longer than 72 hours if high early strength concrete is used.

### 3.06 FINISH OF FORMED SURFACES

#### A. Rough Form Finish:

1. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by other construction unless otherwise indicated.
2. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used with tie holes and defective areas repaired and patched and all fins and other projections exceed ¼-inch in height rubbed down or chipped off.

#### B. Smooth Form Finish:

1. Provide as-cast smooth form finish for formed concrete surfaces that are to be exposed to view or that are to be covered with a coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, damp-proofing, painting or other similar system.
2. Produced smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrical with a minimum of seams. Repair and patch defective areas with all fins or other projections completely removed and smoothed.

#### C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off, smooth, and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces unless otherwise shown.

### 3.07 MONOLITHIC SLAB FINISHES

#### A. Float Finish:

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified.
2. After placing concrete slabs do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float or both. Consolidate the surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding ¼-inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth granular texture.

#### B. Trowel Finish:

1. Apply trowel finish to monolithic slab surfaces that are to be exposed to view unless otherwise shown and slab surfaces that are to be covered with epoxy terrazzo, resilient flooring, paint, or other thin-film finish coating system.
2. After floating, begin the first trowel finish operation using a power-driven trowel if desired.

3. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance and with a surface plane tolerance not exceeding 1/8-inch in 10 feet when tested with a 10-foot straightedge. Grind smooth surface defects, which would telegraph through applied floor covering system.

C. Non-slip Broom Finish:

1. Apply non-slip broom finish to exterior and interior concrete platforms and bridges, steps, walks and ramps and elsewhere as shown on the drawings or in schedules.
2. Immediately after trowel finishing slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Coordinate the required final finish with the Engineer before application.

D. Exposed Aggregate Finish:

1. The Contractor shall construct an exposed aggregate sample thirty-six (36) inches long by thirty-six (36) inches wide, and receive the Owner's approval, prior to any work involving this type of surfacing.
2. Following the Owner's acceptance of the exposed aggregate sample, and immediately after removal of form work, wash concrete surfaces with water and scrub with stiff bristle brush exposing aggregate to match accepted sample panel.
3. When desired finish is achieved, wash and rinse exposed aggregate surfaces with cleaning agent.

E. Carpet Drag Finish:

1. Before the concrete has attained its initial set, the surface shall be given a final finish with a carpet drag drawn over the surface in a longitudinal direction. The drag shall be mounted on a bridge and shall be sized so that a strip of the carpet at approximately two feet (600 mm) wide is in contact with the pavement surface while the drag is operated.
2. The condition of the drag shall be maintained so the resultant surface is of uniform appearance with corrugations approximately 1/16 inch (2 mm) in depth. Drags shall be maintained clean and free of encrusted mortar. Drags that cannot be cleaned shall be discarded and replaced.
3. The carpet shall meet the following requirements:
  - a. Facing Material - Molded polyethylene pile face
  - b. Blade Length - 7/8",  $\pm 1/8$ " (22 mm,  $\pm 3$  mm)
  - c. Total Fabric Weight - 70 oz. Per square yard min.
  - d. (2.37 kg per square meter min.)
4. The backing shall be of a strong, durable material, not subject to rot, which is adequately bonded to the facing.
5. Brooming may be used on irregular areas in lieu of the carpet drag and tine finish. The broom shall be drawn transversely across the pavement with adjacent strokes slightly overlapping.

6. Brooming shall be uniform in appearance and shall produce grooves 1/16 inch (2 mm) deep. Texturing shall be completed while the concrete surface can be broomed without being torn or unduly roughened by the operation.
7. The finished surface shall be free from rough and porous areas, irregularities, and depressions resulting from improper handling of the broom.

### 3.08 CONCRETE SURFACE REPAIRS

#### A. Patching Defective Areas:

1. Repair and patch defective areas with cement mortar immediately after the removal of the forms but only after the Engineer has inspected the defective area.
2. Cut out honeycomb, rock pockets, voids over ½-inch diameter and holes left by tie rods and bolts, down to solid concrete, but, in no case, to a depth of less than 1-inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Engineer.
3. For exposed-to-view surfaces blend white Portland cement and standard Portland cement so that when dry the patching mortar will match the color of the surrounding concrete. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.
4. Fill holes extending through concrete by means of a plunger type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

#### B. Repair of Formed Surfaces:

1. Repair exposed-to-view formed concrete surfaces where possible that contain defects which adversely affect the appearance of the finish. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Engineer. Surface defects as such include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
2. Repair concealed formed concrete surfaces where possible that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects as such include cracks in excess of 0.01 in. wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts and spalls except minor breakage at corner.

### C. Repair of Unformed Surfaces:

1. Test unformed surfaces such as monolithic slabs for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
2. Test unformed surfaces sloped to drain for trueness of slope in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
3. Repair finished unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects as such include crazing, cracks in excess of 0.01-inch wide or that penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
4. Correct high areas in unformed surfaces by grinding after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.
6. Repair defective areas except random cracks and single holes not exceeding 1-inch diameter by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾-inch clearance all around. Dampen all concrete surface in contact with patching concrete and brush with a neat cement grout coating or use concrete bonding agent. Place concrete before grout takes its initial set. Mix patching concrete of the same materials to provide concrete of the same type of class as the original adjacent concrete. Place, compact, and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
7. Repair isolated random cracks and single holes not over 1-inch in diameter by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen all cleaned concrete surfaces and brush with neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack consisting of 1-part Portland cement to 2-½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patch areas continuously moist for not less than 72 hours.
8. Repair methods not specified above may be used subject to the acceptance of the Engineer.

### 3.09 SURFACE TEST AND TOLERANCES

- A. Ten Foot Straightedge: The concrete surface shall be tested with a 10-foot straightedge. The permissible longitudinal and transverse surface deviation shall be 1/8-inch in 10 feet.
- B. Areas where the maximum deviation exceeds the permissible deviation by not more than 3/8 inch will be subject to the following at the discretion of the Engineer.



1. Grind down to an elevation where the area or spot will be within the permissible deviation.
  2. Accept affected area without corrective action with price reduction at a rate noted below.
- C. Areas where maximum deviation exceeds the permissible by more than 3/8 inch will be subject to the following at the discretion of the Engineer.
1. Grind down to an elevation where the area or spot will be within the permissible deviation.
  2. Accept affected area without corrective action with price reduction at a rate noted below.
  3. Satisfactorily remove and replace deficient area.
- D. Grinding shall be accomplished with specially prepared circular diamond blades mounted on a horizontal shaft. Areas that have been ground shall not be left smooth or polished, but shall have a uniform texture equal in roughness to the surrounding unground concrete.
- E. Measurements for determining the limits of deficient areas will be made in the following manner:
1. The length of the deviation will be that length out of specification tolerance at the location of the surface test as checked with a 10-foot straightedge and a 1/8-inch shim.
  2. Where the transverse surface test is out of specification, the maximum length and maximum width at a particular site shall be used in computation of the area.

### 3.10 DEFECTIVE WORK

- A. Concrete work, which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense without extension of time therefore. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

\* \* \* END OF SECTION \* \* \*

# **DIVISION 31 - EARTHWORK**

**SECTION 31 23 00 EXCAVATION AND FILL**

**SECTION 31 23 11 WATERING FOR EMBANKMENTS**

**SECTION 31 23 14 SHEETING, SHORING, AND BRACING**

**SECTION 31 23 33 TRENCHING, BACKFILLING, AND COMPACTING**

**SECTION 31 34 19 GEOTEXTILE FABRICS**



# **SECTION 31 23 00**

## **EXCAVATION AND FILL**

### **PART 1      GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, if attached, apply to the work specified in this section.
- B. Related Work Specified Elsewhere:
  - 1. Watering for Embankments - Section 31 23 11

#### **1.02    DESCRIPTION OF WORK**

- A. The Work covered by this section of the specifications shall consist of furnishing all plant, labor, and equipment, appurtenances and material, and of performing all operations in connection with the excavation, embankment, compaction, topsoiling, and grading required for the reconstruction of the parking lot and streets in accordance with these specifications and in conformity with the dimensions and typical sections shown on the plans and with the lines and grades established by the Engineer.

#### **1.03    CLASSIFICATION OF EXCAVATION**

- A. "Unclassified Excavation" shall include all excavation performed under this section regardless of the material encountered.

#### **1.04    QUALITY ASSURANCE**

- A. During the construction of the subgrade, a representative of the Owner shall be on site to allow for the examination of the exposed subgrade.
- B. In-place density tests will be taken, by the Owner's representative, on each layer of the subgrade (see Geotechnical report).
- C. The Contractor will conduct additional soil tests and quality control testing as desired for his own information and use. The Contractor shall have submitted directly to the Engineer with copies to the Owner, three (3) copies of all field and laboratory tests and reports of inspections performed by him or his agents.
- D. All grades shall be finished to within 0.10 feet of the final elevations as staked by the Owner's authorized representative.

## **PART 2        PRODUCTS**

### **2.01    CONTRACTOR FURNISHED BORROW**

*A. Borrow Material furnished by the Contractor shall be clean earthen fill material free from sticks, roots, stones larger than 3 inches and other deleterious material. **Prior to any hauling the Contractor shall furnish laboratory test results showing the classification of the borrow material by the Unified Soil Classification System (USCS), Liquid Limit, Plasticity Index and Standard Proctor w/ Max Density at Optimum Moisture.** The Borrow material shall meet the USCS requirements for the following soil classifications: (SC) Clayey Sands and (CL) Sandy Clays*

## **PART 3        EXECUTION**

### **3.01    GENERAL**

- A. The excavation shall be carried to the elevations or depths required to obtain the specified depths as shown on the plans. Should the Contractor, through negligence or other fault, excavate below the designated lines or elevations, he shall replace the excavation with suitable materials and properly compact and control the moisture content in a manner as specified herein under "Formation of Embankments". All replacement work shall be at the Contractor's expense.
- B. The Contractor shall inform and satisfy himself as to the character, quantity, and distribution of all material to be excavated. No payment will be made for any excavated material which is used for purposes other than those designated. All spoil areas shall be leveled to a uniform line and section and shall present a neat appearance before project acceptance.
- C. Those areas outside of the embankment areas in which the top layer of soil material becomes compacted due to hauling or to any other activity of the Contractor shall be scarified and disced to a depth of 4 inches as directed to loosen and pulverize the soil.
- D. If it is necessary to interrupt existing surface drainage, sewers, or under drainage, conduits, utilities, or similar underground structures, or parts thereof, the Contractor shall be responsible for and shall take all necessary precautions to protect and preserve or provide temporary service. When such facilities are encountered, the Contractor shall notify the Engineer. The Contractor, at his own expense, shall satisfactorily repair all damage to such facilities or structures which may result from any of his operations during the period of the contract.
- E. The Contractor shall supervise the excavation, moving, placing, and deposition of all material and shall, with the assistance of the Engineer and/or his representative, determine the suitability of materials to be placed in embankments. All material determined to be unsuitable and all excess shall be disposed of in the appropriate areas as shown on plans, or in the outer portions of the embankments.
- F. Topsoil shall not be used directly below any areas to receive surfacing.

### 3.02 STRIPPING

- A. All vegetation such as brush, heavy sods, heavy growth of grass, decayed vegetation, rubbish, roots, and any other unsuitable material within the area to which excavation is to occur, or upon which embankment is to be placed, shall be cleared, stripped, grubbed, and disposed of, before the excavation of suitable materials or a formation of embankment is started.
- B. In no case shall such objectionable material be allowed in or under the subgrades for any areas to receive surfacing.
- C. All depressions or holes below the ground surface, whether caused by grubbing or otherwise, shall be backfilled with suitable material and compacted to the ground surface elevation or up to twelve (12) inches below the proposed final subgrade elevation before the construction of the embankment will be permitted to start.

### 3.03 EXCAVATION OF SUITABLE MATERIAL

- A. Excavation shall be performed to the lines, grades, and elevations as indicated in the plans or as directed by the Engineer and shall be made so that the requirements for formation of embankments and floor can be followed. No excavation or stripping shall be started until the Engineer has taken cross sectional elevations and measurements of the existing ground surface and has provided control stakes for the proposed work. During the process of excavation, the grade shall be maintained so that it will be properly drained at all times. Temporary drains and drainage ditches shall be installed to intercept or divert all surface water which may affect the work.
- B. The suitable excavation material shall be handled in such a manner as to allow the material to be properly placed and compacted in the fill areas.
- C. The Contractor shall make the distribution of the excavated material as indicated in the plans. Widening or narrowing of the section and raising or lowering of the grade to avoid haul will not be permitted. The right is reserved by the Engineer to make minor adjustments or revisions in lines or grades if found necessary as the work progresses to obtain satisfactory construction.
- D. Stones or rock fragments larger than 4 inches in their greatest dimension will not be permitted in the top eight (8) inches of the subgrade or embankment.
- E. All cut-and-fill slopes shall be uniformly dressed to the slope, cross section, and alignment as shown in the plans.
- F. No payment or measurement for payment will be made for suitable materials removed, manipulated, and replaced in order to obtain required density. Any removal, manipulation, aeration, replacement, and recompaction of suitable materials necessary to obtain the required density shall be considered as incidental to the excavation and embankment operations and shall be performed by the Contractor at no additional compensation.

### 3.04 STOCKPILING

- A. If at the time of excavation it is not possible to place any material in its proper section of the permanent construction, it shall be stockpiled in approved areas for later use at no extra cost to the Owner.

- B. The stockpiled material shall be handled and placed as specified in the section of these specifications covering excavation, embankment, and topsoil.
- C. Stockpiles of topsoil or any other material shall be located within the project limits as near the final placement site as practicable. When stockpiling within the project limits is not possible, it shall be the Contractor's obligation to arrange for and maintain stockpile sites at his own expense. Stockpiles of topsoil shall not be placed within 50 feet of embankment areas and shall not be placed on areas which subsequently will require any excavation or embankment.
- D. Prior to Completion of the Work, the Contractor shall obtain and furnish to the Owner a lien waiver or a letter of satisfaction written by the owner of the stockpile area property and addressed to the Contractor.

### 3.05 EXCESS EXCAVATION

- A. When the volume of excavation exceeds that required to construct the embankments to the grades indicated, the excess shall be used to grade the areas of ultimate development or wasted in areas secured by the Contractor, subject to the approval of the Engineer and the Owner. In general, suitable excess excavation will be used in the widening of embankments, flattening of slopes, etc.
- B. If it is necessary to dispose of any material, it shall be disposed of in such a manner as to present a neat appearance and to not obstruct proper drainage or cause damage to abutting property.

### 3.06 PREPARATION OF EMBANKMENT AREA

- A. Prior to the placement of any fill material beneath the proposed trail, the entire layer of topsoil upon which the embankment is to be placed, except where limited by solid rock, shall be removed for its entire depth to the bottom of the natural existing topsoil.
- B. A minimum of six (6) inches of material below the bottom of the natural existing topsoil or to the depth as previously described shall be scarified for the entire width of the subgrade embankment. The area shall be scarified in furrows uniformly spaced so that at least 50% of the surface will be broken to the required depth. All roots, debris, large stones, or objectionable material that would cause interference with the compaction of the foundation for fill shall be removed from the area and disposed of as specified.
- C. After removal and scarifying of the topsoil and other material under the embankment areas, the area should be examined by the Contractor for the existence of unsuitable materials. The Contractor shall notify the Engineer if he feels that unsuitable materials exist. The volume of unsuitable material shall be determined by cross sectioning the area before and after removal. The area of unsuitable material shall be removed to a depth as shown in the plans or as directed by the Owner's representative. The area shall be filled and compacted in accordance with "Formation of Embankments".
- D. A thin layer (approximately 3 inches) of the fill material shall then be uniformly spread over the scarified foundation and the whole area compacted to \_\_\_\_\_% (see Geotechnical report) of maximum density as determined by standard proctor ASTM Test Designation D698 at a moisture content (see Geotechnical report).
- E. Except for the undercut of unsuitable materials which lie at a depth greater than six (6) inches

below finished grade elevation in areas previously described, no direct payment shall be made for work performed under this section.

### 3.07 FORMATION OF EMBANKMENTS

- A. Embankments shall be formed of satisfactory materials placed in successive horizontal layers of not more than 8 inches loose depth for the full width of the cross section.
- B. The grading operations shall be conducted and the various soil strata shall be placed to produce a soil structure as shown in the typical cross section or as directed. All materials entering the embankment shall be reasonably free of organic matter such as leaves, grass, roots, and other objectionable material. Soil, granular material, shale, and any other material permitted for use in embankment shall be spread in successive layers as specified.
- C. The subgrade embankments shall be constructed from the in-place non-organic soils.
- D. Operations on earthwork shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing weather, or other unsatisfactory conditions of the field. The Contractor shall drag, blade, or slope the embankment to provide proper surface drainage. Frozen material shall not be placed in the embankment nor shall embankments be placed over frozen material.
- E. The material in the layers shall be of the proper moisture content before rolling to obtain the prescribed compaction. Wetting or drying of the material and manipulation when necessary to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. Sprinkling shall be done in accordance with the requirements of Section 31 23 11. Samples of embankment materials for testing, both before and after placement and compaction, will be taken. From these tests, corrections, adjustments, and modifications of methods, materials, and moisture content will be made to construct the embankment.
- F. Where a large portion of the materials excavated consist of rock, the rock may be used in the construction of the embankment as hereinafter specified:
  - 1. The maximum dimension of any rock used shall not exceed 12" maximum.
  - 2. Rocks shall be carefully distributed throughout the embankment and imbedded with earth or other fine material so that the interstices between the large particles are filled and a dense, compact, uniform embankment is secured.
  - 3. No rock larger than 4" in any direction will be allowed in the upper eight (8) inches of any embankment as this portion of the embankment shall be composed solely of earth or other suitable material.
- G. The Contractor shall be responsible for the stability of all embankments made under the contract and shall replace any portion which in the opinion of the Engineer has become displaced due to carelessness or negligence on the part of the Contractor. The Contractor shall plan his work so that the necessary compaction tests on each lift can be completed prior to placing additional lifts of material.

### 3.08 DIVERSION DITCHES AND DRAINAGE PROVISIONS

- A. If it is necessary, in the prosecution of the work, to interrupt the natural drainage of the



surface, or the flow of artificial drain, the Contractor shall provide temporary drainage facilities that will prevent damage to public or private interests and shall restore the original drains as soon as the work will permit. The Contractor shall, at his own expense, take all measures necessary to properly drain the work site. The Contractor shall be held liable for all damages which may result from neglect to provide for either natural or artificial drainage which his work may have interrupted. All temporary diversion ditches shall be of adequate size to handle any anticipated flow.

- B. Diversion ditches which are to be permanent shall conform to the shape required in the plans.

### 3.09 TOPSOIL

- A. The topsoil shall be stripped and stockpiled from the regular grading areas and placed on all disturbed areas, at the conclusion of the project, as shown on plans.
- B. All topsoil removed from the excavation areas shall be salvaged (on areas to be grass, topsoil shall be replaced at conclusion of the project).
- C. The stockpiling of topsoil shall be in accordance with the requirements of paragraph 3.04.

### 3.10 TOLERANCES

- A. The subgrade and all other graded surfaces shall be of such smoothness that it will not vary more than 0.10 of a foot from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding, or removing materials, reshaping, and compacting.

### 3.11 WATERING FOR EMBANKMENTS

- A. Refer to Section 31 23 11 - Watering for Embankments.

### 3.12 EQUIPMENT

- A. The Contractor may use any type of earthmoving, compaction, and watering equipment he may desire or has at his disposal, provided the equipment is in a satisfactory condition and is of such capacity that the construction schedule can be maintained as planned by the Contractor and as approved by the Owner in accordance with the completion schedule specified for the construction. The Contractor shall furnish, operate, and maintain such equipment as is necessary to control uniform density, layers, section, and smoothness of grade.

### 3.13 HAUL

- A. No payment will be made separately or directly for haul on any part of the Work. All hauling will be considered a necessary and incidental part of the Work, and its cost shall be considered by the Contractor and included in the contract price for the work involved.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.01 METHOD OF MEASUREMENT**

- A. In the event unsuitable material is encountered during subgrade construction, and the Contractor has requested in writing and received the Engineer's approval, measurement of the additional amount of excavation required, payment for excavation, removal and disposal of said unsuitable material shall be on a cubic yard basis at the contract unit price bid for unclassified excavation.

### **4.02 BASIS OF PAYMENT**

- A. Payment for unsuitable material shall be on a cubic yard basis at the contract unit price bid for unclassified excavation.

\* \* \* END OF SECTION \* \* \*

# **SECTION 31 23 11**

## **WATERING FOR EMBANKMENTS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements, apply to the work of this section.
- B. Related Work Specified Elsewhere:
  - 1. Excavation and Fill - Section 31 23 00

#### **1.02 DESCRIPTION OF WORK**

- A. This item shall consist of furnishing and applying water required in the compaction of embankments and/or the clay cover, and for other purposes in accordance with the requirements of these specifications or as directed.

### **PART 2 PRODUCTS**

#### **2.01 WATER SOURCE**

- A. The Contractor shall obtain a Temporary Water Rights Permit to use water for construction, testing, or drilling purposes from the SD Department of Agriculture and Natural Resources for all water sources. Contact DANR by phone at 605 773-3352 for more information.
- B. The Contractor shall be responsible to provide own source of water for construction. Contractor shall obtain all federal, state, and local permits necessary for sources provided by Contractor. Upon receipt of the permits the Contractor shall submit two copies to the Engineer for his review and approval prior to removal of any water.
- C. The Contractor shall be responsible for all measures necessary to protect the health and safety of all personnel with access to the site.

### **PART 3 EXECUTION**

#### **3.01 CONSTRUCTION METHODS**

- A. Water, when required, shall be applied at the locations, in the amounts, and during the hours, including nights, as required. An adequate water supply shall be provided by the Contractor.
- B. The equipment used for watering shall be of ample capacity and of such design as to assure uniform application of water in the amounts required.
- C. Contractor shall provide information to Engineer on size or capacity of water vehicle used and shall provide daily load counts to the Resident Project Representative.

\* \* \* END OF SECTION \* \* \*

# **SECTION 31 23 14**

## **SHEETING, SHORING, AND BRACING**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Trenching, Backfilling and Compacting - Section 31 23 33
  - 2. Water Utility Piping and Fittings – Section 33 11 00
  - 3. Sanitary Sewer Piping and Fittings – Section 33 31 00

#### **1.02 DESCRIPTION OF WORK**

- A. Furnish and install all necessary sheeting, shoring, and bracing to adequately protect all new and existing structures, all existing piping as may be required during construction period, and all new piping.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS AND CONDITION**

- A. All sheeting, shoring, and bracing shall be in good or new condition and shall conform to the requirements of current safety codes and guidelines.

### **PART 3 EXECUTION**

#### **3.01 METHODS**

- A. All excavation shall be properly shored, sheeted, and braced to furnish safe working conditions conforming to the current codes, regulations, and guidelines; to prevent any shifting and movement of material which may endanger personnel; to prevent damage to structures, or other work; and to avoid delay to the work.
- B. Bracing shall be so arranged as not to place any strain on portions of completed work until the general construction has proceeded far enough to provide ample strength. If the Engineer is of the opinion that at any point the sheeting or supports furnished are inadequate or unsuited for the purpose, he may order additional sheeting or support to be installed. Whether so ordered by the Engineer or not, sufficient sheeting or support shall be installed to protect the work from any damage to new structures.
- C. Trench sheeting shall remain in place until pipe, etc., has been laid, tested for defects, and repaired if necessary, and the earth around it compacted to a depth of one foot over the top of the pipe. Timber sheeting if used shall not be removed below an elevation of two feet above the top of the pipe.
- D. No sheeting, shoring, and bracing which is within three feet of the surface of the finished grade may be left in place without the written permission of the Engineer.

- E. In general, the sheeting and bracing shall be removed as the excavation is refilled in such a manner as to avoid the caving in of the bank or disturbance to adjacent areas or structures. The voids left by the withdrawal of the sheeting shall be carefully filled by ramming or otherwise as directed. Permission of the Engineer shall be obtained before the removal of any shoring, sheeting, or bracing.
- F. It shall be the duty and responsibility of the Contractor to be familiar with all local, state, and federal regulations relating to this type of work and to comply with those regulations.

\* \* \* END OF SECTION \* \* \*

# **SECTION 31 23 33**

## **TRENCHING, BACKFILLING, AND COMPACTING**

### **PART 1      GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the work covered in this Section.
- B. Related Requirements specified elsewhere:
  - 1. Sheeting, Shoring and Bracing - Section 31 23 14
  - 2. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
  - 3. Existing Underground Utilities - Section 33 01 00
  - 4. Water Utility Piping and Fittings – Section 33 11 00
  - 5. Sanitary Sewer Piping and Fittings – Section 33 31 00

#### **1.02    SCOPE**

- A. This section covers the excavation of all necessary trenching for underground utilities and backfilling same after the pipe and related material has been properly laid, inspected and tested all in accordance with applicable federal, state and local laws and regulations.

#### **1.03    QUALITY ASSURANCE**

- A. The Contractor shall obtain qualified testing and inspection services and such other independent services as may be required to assure compliance with the requirements as specified hereinafter. Certified tests of all granular materials will be provided to the Engineer prior to delivery or installation on the job site.
- B. Moisture-density (Proctor) tests on the engineered fill materials and all in-place engineered fill field density tests shall be made as herein specified and in accordance with the General Conditions. Sufficient tests in number and location will be performed so as to assure that the engineered fill is in general compliance with the compaction requirements as specified herein.
- C. The Contractor may conduct additional soil testing and quality control testing as desired for his own information and use.
- D. When requested by the Engineer or Resident Project Representative, the Contractor shall excavate and expose the pipe previously laid at any point.



## **PART 2      PRODUCTS - NOT USED**

## **PART 3      EXECUTION**

### **3.01    GENERAL EXCAVATION**

- A. All material encountered shall be excavated to the lines and grades as shown on the plans, set by the Engineer or as specified herein.
- B. Unless otherwise shown on the plans, trenches for forcemain shall be of a depth that will provide the following minimum covers over the top of the pipe as measured from the original ground surface.
  - 1. Minimum cover for all watermain and forcemain shall be seventy-two (72) inches.
- C. Where pipe elevation is determined by minimum depth only, the excavation shall be sufficient at all points to grade the pipes on the tangents and vertical curves as dictated by the minimum bending radius of the pipe and fittings as recommended by the manufacturers.
- D. The trenches shall be sufficiently straight between designated angle points to permit the pipe to be laid true to line in the approximate center of the trench.
- E. Intersections with and crossings of other underground utilities shall be as shown on the plans and/or in accordance with applicable state and local laws and regulations. Refer to Section 33 01 00 for additional requirements.
- F. All excavated material suitable for backfilling shall be placed in an area away from the trench edges so as to avoid overloading, sliding, and cave-ins.
- G. The areas immediately adjacent to the trench shall be graded as required to prevent surface water from entering the trenches.

### **3.02    EXCAVATION FOR APPURTENANCES**

- A. A minimum of twelve (12) inches shall be left between the trench wall and the outside surface of the appurtenance.

### **3.03    SHEETING, SHORING AND BRACING**

- A. Refer to Section 31 23 14 of these specifications

### **3.04    ROAD, STREET, AND DRIVEWAY CROSSINGS**

- A. At such road and all other crossings as may be designated by the Engineer, the trenches are to be mechanically tamped and filled in such a manner as to prevent any serious interruption of traffic upon the roadway or crossing.
- B. Not more than one street crossing may be obstructed by the same trench at any one time except by permission of the Engineer and Owner.

### **3.05    ROCK EXCAVATION**

- A. Rock excavation shall be completed to a minimum of eight (8) inches below and on each side

of all pipes, valves, fittings, and other appurtenances.

- B. Excess excavation shall be backfilled with compacted material conforming to the bedding material required for the material being used.

### 3.06 DEWATERING

- A. Where water is encountered in a trench, water shall be removed by pumping to lower the water level to such elevation that the pipe may be laid dry at the grade shown on the plans.
- B. All water pumped from the trench shall be disposed of in a manner so as not to cause any damage to adjacent property.
- C. When dewatering is paid for, it shall be considered as dewatering only when a manifold or pump and system of well points is installed to lower ground water such that excavation and construction can take place.
- D. The process of pumping water out of the trench with a suction hose and pump will not be considered as dewatering.
- E. Where seepage of water into the trench occurs that can be removed using standard pumping procedures, it shall not be deemed sufficient cause for installing a system of manifolds and well points and classified as dewatering in order to obtain remuneration under the Bid Item - Dewatering.
- F. A dewatering permit is required when the discharge from dewatering may reach the waters of the state. To obtain information on the General Dewatering Permit, the Contractor should contact the Department of Environment and Natural Resources at (605) 773-3351.

### 3.07 TRENCH BOTTOM PREPARATION

- A. The sides of all trenches shall be vertical from the bottom of the trench to a point one (1) foot above the top of the pipe.
- B. The width of the trench shall be a minimum of twelve (12) inches on each side of the pipe bell.
- C. The bottom of all trenches for underground piping shall be carefully and accurately formed to the lines and grades as shown on the plans, set by the Engineer or as specified herein.
- D. Rock, boulders, and large stones, or other manmade material shall be removed to provide a clearance of at least eight (8) inches below the outside barrel of the pipes, valves, fittings appurtenances. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. The space between the rock at the bottom of the trench and the bottom of the pipe barrel shall be filled with compacted bedding material.
- E. If the trench bottom is inadvertently excavated deeper than necessary, it shall be backfilled to the proper grade with compacted bedding material.

### 3.08 UNSTABLE TRENCH BOTTOM

- A. Whenever wet, soft or unstable soils incapable of properly supporting the pipe, or other appurtenances are encountered in the trench, the Contractor shall be required to remove the unsuitable materials and backfill to the proper grade with concrete, granular material or other suitable approved material.

- B. Backfill material shall be compacted to provide a firm and level support for the piping system. Firm support is defined as no visual deformation in the surface when workers walk on the compacted material.

### 3.09 BACKFILLING AND COMPACTING

- A. Any trenches improperly backfilled or showing excessive settlement shall be reopened to a depth required for proper compaction.
- B. Backfill material shall be free of boulders, frozen clods, large roots, excessive sod or other vegetation, construction debris.
- C. No backfilling shall take place in freezing weather without written permission from the Engineer.
- D. Borrowed granular bedding material shall conform to the gradation indicated below.

<u>Sieve Opening</u>	<u>Bedding Material (Percent Passing)</u>
1"	95-100
No. 200	< 15

- E. Bedding material excavated from the job site shall be finely divided material free from organic material and clods, lumps of frozen material or stones larger than 1 1/2" in maximum diameter. Bedding material shall be of proper moisture content to form a firm bed for the pipe.
- F. The bedding material backfilling around the pipe shall be deposited in layers not to exceed eight inches (8") and carefully compacted to a degree of compaction at least equal to 90% maximum dry density as determined by Standard Proctor Test, ASTM Test Designation D698 throughout the entire depth of each layer. Where the pipe has a protective coating, care shall be taken not to damage the coating.
- G. The embedment material shall be finely divided material free from debris, organic material, and clods, lumps or stones larger than 1-1/2 inches maximum diameter. The material shall be borrowed material or job site excavated material. Embedment material shall be placed in uniform layers not more than twelve (12) inches thick and compacted to 90% maximum density as determined by ASTM D698 until the pipe has a cover of not less than one (1) foot.
- H. The remainder of the backfill shall consist of selected material from excavation or borrow, and shall be free from cinders, ashes, refuse, organic and frozen material, boulders or other materials that are unsuitable. Stones larger than 3 inches in diameter shall not be placed within two feet of the top of the pipe. This material shall be placed from 12 inches above the top of the pipe to 6 inches below the ground surface, unless otherwise specified, or to the subgrade elevation for streets or paved surfaces.
- I. After completing the bedding and embedment of the pipe as specified above, the remainder of the backfill material beneath unpaved areas shall be placed in uniform layers not exceeding one (1) foot and tamped. It shall be the Contractor's responsibility to compact each layer throughout its entire depth to a degree of compaction at least equal to that of the surrounding earth. The Contractor shall moisten or aerate the backfill material to obtain the required compaction. The Contractor shall provide a final cover of topsoil as specified herein. Any additional settlement of the trench shall be brought back to grade with additional

topsoil. The trench shall be left in a condition so as to present a neat appearance.

- J. Open trenches under road surfacing, sidewalks, curb and gutter, and other adjacent improvements to a point eight (8) feet from the edge of the road surface and as otherwise noted on the plans shall be backfilled with uniform layers not exceeding one (1) foot. Each layer, except the upper 6 inches of subgrade underlying the pavement, shall be spread uniformly and tamped with a hand tamper or other approved device until thoroughly compacted to at least 90% of the maximum density obtainable at optimum moisture content. The upper 6-inch layer, forming the subgrade for surfacing shall be compacted to at least 97% of the maximum density obtainable at optimum moisture content. Density of backfill shall be determined based on Standard Proctor Test, ASTM Test Designation D698.

### 3.10 TESTING REQUIREMENTS

- A. Frequency of Testing: Minimum of one (1) test every 250 feet to 350 feet of trench per lift or as directed by Engineer. Frequency of testing may be altered by Engineer after adequate testing is completed to determine level of effort by Contractor is sufficient. When frequency is altered by the Engineer, random testing will be performed to verify compaction efforts. The Contractor may be required to excavate to depths required by Engineer for testing and backfill test holes to density specified.
- B. Retesting: In the event of failure to meet compaction criteria, the Contractor shall re-excavate and re-backfill at direction of Engineer. All retesting to be paid for by Contractor and to be performed by soils testing firm secured by the Contractor and approved by the Engineer.

### 3.11 EXCESS EXCAVATION

- A. The Contractor shall be responsible for securing and maintaining an adequate area where excess excavation can be stockpiled for future use or wasted.
- B. The Engineer's approval on the site selection shall be required.
- C. The Contractor shall be responsible for the final cleanup of the site chosen. The site shall be cleaned to the satisfaction of the property owner, and a lien waiver or a letter of satisfaction written by the property owner and addressed to the Contractor shall be obtained by the Contractor and furnished to the Owner.

### 3.12 TOPSOIL

- A. All lawns areas shall be left smooth with a minimum of 6" of compacted black dirt throughout the entire area disturbed by the trench.
- B. Prior to topsoiling and finish grading, all rough grades shall be corrected, adjusted, and brought to the required elevations.
- C. The subgrade surface shall be prepared for topsoiling by cross disking to a depth of two (2) inches or more to permit bonding of the topsoil to the subgrade.
- D. All stones and other debris greater than two (2) inches in any dimension shall be removed from the surface of the subgrade prior to the placement of the topsoil.
- E. Topsoil material shall not be placed when the topsoil or subgrade is frozen or wet enough to cause clodding.

- F. Topsoiling operations adjacent to lagoons and along piping routes shall be considered complete when the finished surface is:
1. Free of sticks, stones and other material one (1) inch or more in any dimension.
  2. Smooth and true to required grades with a maximum allowable deviation of 0.1 foot.
- G. All lawns shall be raked with a landscape rake, garden rake, or other approved equipment to remove all clods, stones, sticks, or other material greater than one (1) inch in any dimension. Trenches shall be slightly crowned and all disturbed areas smoothed to a maximum deviation of 0.1 foot and ready for seeding operations by Contractor prior to acceptance by the Engineer.

\* \* \* END OF SECTION \* \* \*

# **SECTION 31 34 19**

## **GEOTEXTILE FABRICS**

### **PART 1      GENERAL**

#### **1.01    SUMMARY**

- A. This section includes the requirements for furnishing and installing geotextile fabric as shown on the plans.

#### **1.02    RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this section.
- B. Related Work specified elsewhere:
  - 1. Excavation and Fill - Section 31 23 00
  - 2. Aggregate Material - Section 32 11 23

#### **1.03    QUALITY ASSURANCE**

- A. When geotextile meeting or exceeding the required property values have been submitted and approved, the properties used for quality control shall be properties established by geotextile manufacturer for this type of product and not the values specified herein.

#### **1.04    DELIVERY, HANDLING, AND STORAGE**

- A. Geotextile shall be provided in rolls wrapped in relatively impermeable and opaque protective covers with the following clearly marked on each roll.
  - 1. Manufacturer's name.
  - 2. Product identification.
  - 3. Lot and roll number.
  - 4. Roll dimensions.
- B. Geotextile shall be stored in a dry location above the ground surface. Geotextile shall not be stored directly on the ground.
- C. Geotextile shall be handled in accordance with the manufacturer's recommendations to prevent damage to material during unloading, handling, and installation operations.

### **PART 2      PRODUCTS**

#### **2.01    GENERAL**

- A. The Contractor shall furnish materials whose minimum roll values meet or exceed project requirements.
- B. The geotextile fabric shall have polymeric yarns or fibers oriented into a stable network to retain relative structure during handling, placement, and service.

## 2.02 GEOTEXTILE FABRIC PROPERTIES

- A. The Contractor shall provide a Certificate of Compliance verifying that the material meets the following specifications or documentation that the material is listed on the approved products list. All values listed are Minimum Average Roll Values (MARV) unless otherwise specified.
- B. The geotextile shall be furnished and stored at the site in a protective wrapping which shall protect the fabric from ultraviolet radiation and from abrasion due to shipping and handling. If the geotextile is to be exposed directly to sunlight in excess of two weeks, the fabric shall be ultraviolet stabilized.

**TABLE 1 - GEOTEXTILE AND IMPERMEABLE PLASTIC MEMBRANE**

		Drainage Fabric			Geotextile Separator			
Fabric and Membrane Property	Test Method	Type A	Type B	Silt Fence	Woven	Non-Woven	MSE Geotextile Fabric	Impermeable Plastic Membrane
PERFORMANCE CRITERIA DURING SERVICE LIFE								
Equivalent or Apparent Opening Size, US Standard Sieve	ASTM D4751	40-100	40-100	20-70	* 40-100	40-100	40-100	- - -
Thickness, Mils	ASTM D1777	- - -	- - -	- - -	- - -	- - -	- - -	12
Permittivity, Sec-1	ASTM D4491	0.2 Min	0.3 Min	0.4 Min	0.05 Min	0.1 Min	0.005 Min	<0.0000010 cm/sec <sup>(6)</sup>
STRENGTH REQUIREMENTS								
Wide Width Strip Tensile Strength, lbs/inch Machine & X-Machine Direction	ASTM D4595 <sup>(2)</sup>	40	90	- - -	130	65	200	80
Grab Strength, lbs Machine & X-Machine Direction	ASTM D4632	- - -	- - -	90 Min	- - -	- - -	- - -	- - -
Elongation at Failure, % Machine & X-Machine Direction	ASTM D4595 <sup>(2)</sup>	40 Min	50 Min	- - -	20 Min	20 Min	35 Max	20 Min
Burst Strength, psi	ASTM D3786 Diaphragm Method	130	290	- - -	290	210	430	- - -
Trapezoid Tear Strength, lbs	ASTM D4533 Any Direction	25	75	- - -	50	40	75	50
Puncture Strength, lbs	ASTM D4833 <sup>(3)</sup>	25	90	- - -	75	50	110	60
ENVIRONMENTAL REQUIREMENTS								
Mildew/Rot Resistance, %	AATCC 30 1988 <sup>(5)</sup>	100	100	- - -	100	100	100	100
Insect/Rodent Resistance, %	AATCC 24 1985 <sup>(5)</sup>	100	100	- - -	100	100	100	100
Ultraviolet Resistance, % Strength Retention	ASTM D4355	(4)	(4)	70	(4)	(4)	(4)	(4)
TYPICAL USES								
		a	b	c	d	d	e	f

\*Note: The actual AOS of the silt fence should only have one value for AOS on the certification. To be approved the value shall be within the allowable range specified above.

- (2) 8" wide x 4" length (200 x 100 mm) specimen tested at a strain rate of 10% (0.4 inch) (10 mm) per minute.
- (3) Using 5/16" (8 mm) diameter flat tipped steel cylinder centered with ring clamp.
- (4) Non-stabilized or low susceptible geotextiles should not be exposed to ultraviolet radiation for more than 5 days.
- (5) American Association of Textile Chemists and Colorists test procedures.
- (6) Permeability Coefficient (ASTM D 4491).
- (a) Joints for concrete pipe culverts & RC boxes, edge drains, drainage tubing, etc. Used as a general filtration fabric.
- (b) Riprap, gabions, inslopes retention on MSE backfill, etc. Use-same as (a) except has a higher construction loading.
- (c) Medians, ditches, slopes, etc. Used to filter sediment-laden water.
- (d) Subgrades, embankments, etc. Used to separate granular material from subgrade.
- (e) Bridge End Backfill and reinforced slopes. Used to create a reinforced fill and/or used as the wall facing material.
- (f) Under pavements. Used to restrict the flow of fluids to underlying materials.

## 2.03 STAPLES

- A. Staples for the filter fabric, if used, shall be made of 11-gauge or heavier steel wire. The staples shall be "U" shaped with a 1-inch crown, and legs with a minimum of 8-inches in length.
- B. Installation shall be in accordance with the manufacturer's recommendations.

## **PART 3 EXECUTION**

### 3.01 GEOTEXTILE INSTALLATION

- A. The Contractor shall install all geotextile fabrics according to manufacturer's recommendations and as specified herein.
- B. On side slopes, the geotextile shall be rolled down slope in such a manner as to continually keep geotextile in tension.
- C. In presence of wind, Contractor shall weight geotextile during placement with sufficient sand bags, or equivalent, to keep geotextile in place during placement of granular materials.
- D. During placement of geotextile, care shall be taken not to entrap in or under geotextile, stones, excessive dust, or moisture that could damage clay liner or hamper subsequent seaming operations.
- E. Do not expose geotextile to precipitation prior to or during installation, and do not expose geotextile to direct sunlight for more than 15 days, unless otherwise specified.
- F. All overlaps of geotextile fabrics shall be oriented in direction of earth filling.
- G. The Contractor shall repair all tears in geotextile prior to installation of granular materials. The repair procedures shall be as recommended by manufacturer and as outlined below.
  - 1. On slopes, a fabric patch shall be sewn in place over the tear with a minimum overlap of 24 inches in each direction. The patch shall be continually sewn using a double sewn lock stitch, seams 1/4 to 3/4 inches apart and no closer than 1 inch from any edge.
  - 2. Should any tear exceed 10% of the roll width, the roll shall be removed from the slope and replaced.
  - 3. On non-slopes, the fabric patch may be spot sewn with a minimum overlap of 24 inches



in each direction.

4. All soil or granular material, which may have penetrated torn geotextile shall be removed and the area grade smooth.
- H. Geotextile shall be installed around all appurtenances protruding through geotextile as recommended by manufacturer and as specified below.
1. Holes for pipes and appurtenances shall be the minimum size necessary for installation.
  2. The Contractor shall patch, seam, sew, or overlap the geotextile material around the pipe or appurtenances to provide a barrier against particle migration into or out of the geotextile fabric.

\* \* \* END OF SECTION \* \* \*

# **DIVISION 32 –EXTERIOR IMPROVEMENTS**

**SECTION 32 11 23 AGGREGATE MATERIAL**

**SECTION 32 12 13.13 BITUMINOUS TACK COAT**

**SECTION 32 12 16 ASPHALT CONCRETE SURFACING**

**SECTION 32 11 26.16 MILLING/PULVERIZATION OF EXISTING ASPHALT  
SURFACE AND BASE**

**SECTION 32 16 00 CURBS, GUTTERS, SIDEWALKS AND DRIVEWAYS**



# SECTION 32 11 23

## AGGREGATE MATERIAL

### **PART 1 GENERAL**

#### 1.01 RELATED DOCUMENTS

- A. The general provisions of the contract, including General and Special Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Asphalt Concrete Surfacing - Section 32 12 16

#### 1.02 DESCRIPTION OF WORK

- A. Aggregates shall be hauled, spread, compacted, and laid to grade as staked by the Owner's representative and shown on plans.

#### 1.03 QUALITY ASSURANCE

- A. The finished grade of the base course/gravel cushion shall be within 0.05 feet at any point, as staked and checked by the Owner's Representative.

### **PART 2 PRODUCTS**

#### 2.01 BASE COURSE/GRAVEL CUSHION

- A. The aggregates shall consist of sound durable particles of gravel and sand with which may be included limited amounts of fine soil particles. The physical characteristics and quality of the materials shall conform to the specifications for the particular material required by the contract as follows:

REQUIREMENT	Aggregate Base Course	Gravel Cushion
SIEVE	PERCENT PASSING	
2" (50 mm)		
1" (25.0 mm)	100	
3/4" (19.0 mm)	80-100	100
1/2" (12.5 mm)	68-91	
No. 4 (4.75 mm)	46-70	50-75
No. 8 (2.36 mm)	34-58	38-64
No. 40 (425 µm)	13-35	15-35
No. 200 (75 µm)	3.0-12.0	3.0-12.0

REQUIREMENT	Aggregate Base Course	Gravel Cushion
SIEVE	PERCENT PASSING	
Liquid Limit Max	25	25
Plasticity Index	0-6	0-6
L.A. Abra. Loss, max.	40	40
Foot Notes	1,2	
Processing Required	crushed	crushed

<sup>1</sup> The fraction passing the No. 200 (75 µm) sieve shall not be greater than 2/3 of the fraction passing the No. 40 (425 µm) sieve. In no case shall the upper limit specified for the No. 200 (75 µm) sieve be exceeded.

<sup>2</sup> Requirements include quarried ledge rock.

- B. Granular material of which 30% of the particles retained on the No. 4 sieve shall contain one or more fractured faces. A crushed particle shall be defined to be a fragment of stone showing at least one freshly fractured face.

### **PART 3 EXECUTION**

#### **3.01 BASE COURSE**

- A. Base course material, meeting the requirements as set forth in Part 2 above, shall be furnished and installed (under asphalt and concrete pavement) to obtain the desired grades, as shown on the plans. The base course material shall then be compacted to 97% of maximum density (see Geotechnical report) between 3% below and 3% above optimum moisture.

#### **3.02 GRAVEL CUSHION**

- A. Gravel cushion material, meeting the requirements as set forth in Part 2 above, shall be furnished and installed (under sidewalks) to obtain the desired grades, as shown on the plans. No density requirements are needed under the sidewalk but the material shall be approved by the Engineer prior to placement of the fiber/rebar reinforced concrete sidewalks.

#### **3.03 UNSUITABLE MATERIAL**

- A. Unsuitable material shall be excavated and replaced with approved base course material as designated by the Owner or his Representative. No additional compensation shall be considered for this operation.

\* \* \* END OF SECTION \* \* \*

## **SECTION 32 12 13.13**

### **BITUMINOUS TACK COAT**

#### **PART 1      GENERAL**

##### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Asphalt Concrete Surfacing - Section 32 12 16

##### **1.02    DESCRIPTION OF WORK**

- A. This item shall consist of preparing and treating a bituminous surface with bituminous material in accordance with these specifications and in reasonably close conformity to the lines shown on the plans.

##### **1.03    QUALITY ASSURANCE AND SUBMITTALS**

- A. Samples of the bituminous material that the Contractor proposes to use, together with a statement as to its source and character, must be submitted and approved before use of such material begins. The Contractor shall require the manufacturer or producer of the bituminous material to furnish material subject to this and all other pertinent requirements of the contract. Only satisfactory materials so demonstrated by service tests, shall be acceptable.
- B. The Contractor shall furnish the vendor's certified test reports for each carload, or equivalent, of bituminous material shipped to the project. The report shall be delivered to the Engineer before permission is granted for use of the material. The furnishing of the vendor's certified test report for the bituminous material shall not be interpreted as a basis for final acceptance. All such test reports shall be subject to verification by testing samples of material received for use on the project.
- C. Before the final estimate is allowed, the Contractor shall file with the Engineer receipted bills when railroad shipments are made, and certified weigh bills when materials are received in any other manner, of the bituminous materials actually used in the construction covered by the contract. The Contractor shall not remove bituminous material from the tank car or storage tank until the initial outage and temperature measurements have been taken by the Engineer, nor shall the cart or tank be released until the final outage has been taken by the Engineer. Copies of freight bills and weigh bills shall be furnished to the Engineer during the progress of the work.

## **PART 2      PRODUCTS**

### **2.01    MATERIALS**

- A. The bituminous material shall be either cutback asphalt, emulsified asphalt, or tar and shall conform to the requirements of Table 1. The type, grade, controlling specification, and application temperature of bituminous material to be used shall be specified by the Engineer.

<b>TABLE 1. BITUMINOUS MATERIAL</b>			
TYPE AND GRADE	SPECIFICATION	APPLICATION TEMPERATURE	
		DEG. F.	DEG. C
Emulsified Asphalt	ASTM D977	75-130	25-55
SS-1h, CSS-1h	ASTM D2397	75-130	25-55

## **PART 3      EXECUTION**

### **3.01    WEATHER LIMITATIONS**

- A. The tack coat shall be applied only when the existing surface is dry and the atmospheric temperature is above 60 degrees F (15 degrees C). The temperature requirements may be waived, but only when so directed by the Engineer.

### **3.02    EQUIPMENT**

- A. The Contractor shall provide equipment for heating and applying the bituminous materials.
- B. The distributor shall be designed, equipped, maintained, and operated so that bituminous material at even heat may be applied uniformly on variable widths of surface at the specified rate. The allowable variation from the specified rate shall not exceed 10 percent. Distributor equipment shall include a tachometer, pressure gages, volume-measuring devices, or a calibrated tank, and a thermometer for measuring temperatures of tank contents. The distributor shall be self-powered and shall be equipped with a power unit for the pump and full circulation spray bars adjustable laterally and vertically.
- C. A power broom and/or blower shall be provided for any required cleaning of the surface to be treated.

### **3.03    APPLICATION OF BITUMINOUS MATERIAL**

- A. Immediately before applying the tack coat, the full width of surface to be treated shall be swept with a power broom and/or air blast to remove all loose dirt and other objectionable material.
- B. Emulsified asphalt shall be diluted by the addition of water where directed by the Engineer and shall be applied a sufficient time in advance of the paver to ensure that all water has evaporated before any of the overlying mixture is placed on the tacked surface.

- C. The bituminous material including vehicle or solvent shall be uniformly applied with a bituminous distributor at the rate of 0.10 to 0.15 gallons per square yard (0.24 to 0.72 liters per square meter) depending on the condition of the existing surface. The type of bituminous material and application rate shall be approved by the Engineer prior to application.
- D. Following the application, the surface shall be allowed to cure without being disturbed for such period of time as may be necessary to permit drying out and setting of the tack coat. This period shall be determined by the Engineer. The surface shall then be maintained by the Contractor until the next course has been placed. Suitable precautions shall be taken by the Contractor to protect the surface against damage during this interval.

\* \* \* END OF SECTION \* \* \*





# **SECTION 32 12 16**

## **ASPHALT CONCRETE SURFACING**

### **PART 1      GENERAL**

#### **1.01    RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Bituminous Tack Coat – Section 32 12 13.13

#### **1.02    DESCRIPTION OF WORK**

- A. The work covered under these specifications shall include the furnishing of all labor, materials, and equipment necessary to lay a compacted asphalt concrete mat (at a depth as indicated in the plans), complete in place, as specified herein.

#### **1.03    SUBMITTALS**

- A. The Contractor shall submit for review copies of all certificates from the manufacturer that the materials meet or exceed specified requirements.

#### **1.04    QUALITY ASSURANCE**

- A. The contractor shall provide the required control tests of the mineral aggregate for the asphalt surfacing. The cost is considered incidental to the project.
- B. The contractor shall provide the required job mix, prepared by an independent testing laboratory approved by the Engineer for the Class G, Type 1 Asphalt concrete to the Engineer/Owner 14 days prior to start of production. The cost of the job mix designs shall be paid for by the Contractor and are considered incidental to the project.
- C. Following the Engineer's approval of the above-mentioned tests, all remaining tests shall be performed by the Owner's representative with results being given to both the Contractor and the Owner.

### **PART 2      PRODUCTS**

#### **2.01    GENERAL**

- A. Specifications to be used for this section shall be the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 Edition, Division III Materials Details with the following modifications, and/or special provisions.

1. Where the term Engineer, Area Engineer, Department, etc., is used it shall be replaced with Helms and Associates, Owner etc. as applicable.
2. The shale content or other particles of low specific gravity (less than 1.95) passing the No. 4 sieve shall not exceed four (4) percent.

## 2.02 ASPHALT CONCRETE

- A. The construction requirements and material handling shall conform to the requirements of Section 320/321, Section 880, and Section 890 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 edition.
- B. Mineral aggregate for asphalt concrete shall conform to the requirements of the standard specifications for Class G, Type I. The asphalt cement shall be PG 64-22 or PG 64-28. The Contractor shall provide a job mix formula with the supporting mix design data prior to production.
- C. A bituminous tack coat (SS-1H or CSS-1H) shall be applied between each lift at a rate of 0.10 to 0.15 gallon per square yard.

## **PART 3 EXECUTION**

### 3.01 GENERAL

- A. The construction requirements and material handling shall conform to the requirements of Section 320/321, Section 880, and Section 890 of the South Dakota Department of Transportation Standard Specifications for Roads and Bridges, 2015 Edition, except as modified hereinafter.
  1. Where the term Engineer, Area Engineer, Department, etc. is used it shall be replace Helms and Associates, Owner etc. as applicable.

### 3.02 ASPHALT CONCRETE SURFACE

- A. Asphalt concrete surfaces will be replaced in the areas as designated by the Owner and Engineer.
- B. Placement of asphalt concrete surfaces shall be on compacted granular base course as indicated on the plans. The compacted thickness of asphalt concrete shall be as shown on the plans or as directed by the Owner and Engineer.
- C. The contractor shall adjust and cover all manholes and valve boxes, prior to tack coat application, with material approved by the Engineer.

### 3.03 GENERAL

- A. The Asphalt Concrete Paving equipment, weather limitations, job mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

### 3.04 MIXING ASPHALTIC CONCRETE MATERIALS

#### A. Provide hot plant-mixed asphaltic concrete paving materials.

1. Temperature leaving the plant: 143 degrees C (290 degrees F) minimum, 160 degrees C (320 degrees F) maximum.
2. Temperature at time of placing: 138 degrees C (280 degrees F) minimum.

### 3.05 SUBGRADE

#### A. Shape to line and grade and compact with self-propelled rollers.

#### B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

#### C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

#### D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

#### E. Proof-roll the subgrade with weighted dump truck as directed by Engineer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

### 3.06 BASE COURSES

#### A. Base

##### 1. Spread and compact to the thickness shown on the drawings.

##### 2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.

##### 3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.

#### B. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

#### C. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).

#### D. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

### 3.07 PLACEMENT OF ASPHALTIC CONCRETE PAVING

#### A. Remove all loose materials from the compacted base.

#### B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer's recommendations as approved by the Architect or Engineer.

#### C. Receipt of asphaltic concrete materials:

##### 1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C (280 degrees F).

##### 2. Do not commence placement of asphaltic concrete materials when the atmospheric

temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:

1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:

1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown on the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
  - a. No depressions which will retain standing water.
  - b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.08 PROTECTION

- A. Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.09 FINAL CLEAN-UP

- A. Remove all debris, rubbish, and excess material from the work area.

\* \* \* END OF SECTION \* \* \*

# **SECTION 32 11 26.16**

## **MILLING/PULVERIZATION OF EXISTING ASPHALT SURFACE AND BASE**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to work covered in this section.
- B. Related requirements specified elsewhere:
  - 1. Excavation and Fill – Section 31 23 00

#### **1.02 DESCRIPTION OF WORK**

- A. This work shall consist of milling/pulverizing the existing asphalt concrete surface and existing asphalt cinder base, placing and compacting to the lines, grades, and dimensions shown on the plans.

### **PART 2 PRODUCTS**

#### **2.01 SALVAGED ASPHALT AND BASE**

- A. The material shall consist of a mixture of existing asphalt pavements and base materials lying under the pavement. Existing asphalt pavement and bases shall be milled and pulverized. The material shall have a uniform gradation meeting the following minimum requirements:

<b>Sieve Designation (square openings) as per ASTM C 136</b>	<b>Percentage by Weight Passing Sieves</b>
3 inch (75.0 mm)	100
No. 10 (2.0 mm)	20-100
No. 40 (0.450 mm)	5-60
No. 200 (0.075 mm)	0-15

#### **2.02 GEOTEXTILE SEPARATOR**

- A. See Section 31 34 19.

### **PART 3 EXECUTION**

#### **3.01 MILLING AND PULVERIZATION**

- A. The existing pavement and base shall be milled and/or scarified and pulverized to the depth shown on the plans ( $\pm 9$  inches). The milling or pulverization can be accomplished in a single pass milling operation, or, a multi-step process can be utilized which consists of scarification, windrowing, and pulverization. All material shall be pulverized so that material will have a

uniform gradation.

### 3.02 SPREADING AND COMPACTION

- A. The recycled material shall be uniformly spread over a geotextile fabric. The material shall be spread to form a minimum compacted depth of 6-inches as shown in the plans or modified in the field by the Engineer. The material will be compacted to a maximum attainable density without jeopardizing the stability of the subgrade.
- B. Test holes may be dug at specified intervals to determine the compacted thickness of the layer being placed. Areas with a deficiency of more than 1/2-inch compacted thickness shall be reworked with added mixed material sufficient to increase the layer to the depth specified. All irregularities developing in the surface shall be corrected by blading. Blading and compaction shall continue until the surface is true to grade and cross-section. Final compaction shall be obtained by rolling with an appropriately sized steel-wheeled or pneumatic-tired roller.

### 3.03 EQUIPMENT

- A. The equipment used on the project shall include any of the following pieces which are considered necessary: scarifiers, pulverizing equipment, rotary mixers or travel plants, motor graders, windrow devices, aggregate spreaders, power brooms or power blowers, self-propelled vibratory or steel-tired tandem and pneumatic-tired rollers capable of attaining the required density, and a water distributor. Other equipment may be used in addition to, or instead of, the specified equipment when approved by the Engineer.

### 3.04 COMPACTION

- A. Rolling operations shall begin immediately upon completion of the spreading. The number, type, and weight of rollers shall be sufficient to compact the material to the maximum attainable density.
- B. The maximum attainable density will be determined by preparing a test area within the construction area for placement of recycled material. After the mixture is spread as specified, the layer of material shall be uniformly compacted by successive passes of roller equipment over the test area. A successive pass shall be one complete pass over the test area with the roller equipment. After four successive passes of the roller, the engineer will perform density tests on the layer. Continue the successive roller passes until 4 successive roller passes fail to increase the average wet density by 1.0 pcf. If in the opinion of the Engineer, the subgrade stability is compromised during the testing procedure, the Contractor will discontinue compaction efforts. The engineer will perform density tests on the layer, and the maximum attainable density will be the highest value obtained during the test procedure. The Contractor will use the same compaction procedures on the remaining site. The maximum attainable density test value will be used for quality control on the site.
- C. The moisture content of the material during placing operations shall be  $\pm 2$  percentage points of the optimum moisture content as determined by ASTM D 698.

### 3.05 ACCEPTANCE SAMPLING AND TESTING FOR DENSITY

- A. Each area tested will be accepted for density when the field density has achieved the maximum attainable density, without jeopardizing the subgrade, as determined in the field by the Engineer. The in-place field density shall be determined in accordance with ASTM D1556 or D2167.

\* \* \* END OF SECTION \* \* \*





# **SECTION 32 16 00**

## **CURBS, GUTTERS, SIDEWALKS AND DRIVEWAYS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.
- B. Related requirements specified elsewhere:
  - 1. Trenching, Backfilling and Compaction - Section 31 23 33
  - 2. Asphalt Concrete Surfacing – Section 32 12 16

#### **1.02 SCOPE**

- A. This section covers the labor, materials, equipment and related services necessary to install or repair pavement and related structures damaged during construction.

#### **1.03 QUALITY ASSURANCE**

- A. The Contractor shall be responsible for obtaining the services of a qualified testing firm as may be required to assure compliance with the requirements of these specifications.

#### **1.04 SUBMITTALS**

- A. A complete description of the materials to be used in the Work covered by this Section of the specifications shall be submitted to the Engineer for review.
- B. Three (3) copies of all reports and test results completed by the independent testing service shall be submitted directly to the Engineer.

### **PART 2 PRODUCTS**

#### **2.01 CONCRETE**

- A. See Division 030000.

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. After completing proper compaction of the backfill, the Contractor shall replace the disturbed surfaces to the original grade. Surfacing material, as specified herein shall be replaced to the same depths and limits with the same type of material as the surfacing material removed, unless otherwise shown on plans.
- B. A flush, smooth, adjoining surface transition shall be provided.
- C. Existing asphalt paved surface, sidewalks, curb and gutter, concrete or asphalt driveways and alley approaches shall be scored along a straight line by a concrete saw to a depth of two (2)

inches (or by a method previously approved by the Engineer) at a distance of two (2) feet beyond each edge of proposed ditch. The remaining thickness of surfaces shall be fractured to a true vertical face. All exposed faces shall be adequately cleaned to ensure bonding between new and existing surfaces and cut and fractured to a vertical face immediately prior to placement of the new surfacing.

- D. Placement of concrete or asphalt on frozen surfaces will not be permitted.
- E. Concrete surfaces shall be cured and protected for a sufficient period of time (not less than 3 days) to prevent damage to concrete and insure required compressive strength requirements.

### 3.02 CONCRETE SIDEWALK

- A. Concrete Sidewalk shall be replaced at locations as designated by the Engineer with nominal five (5) inch thick fiber reinforced concrete on eight (8) inch compacted gravel cushion.
- B. Sidewalk to be replaced shall be removed to nearest expansion or scored joint from each edge of the trench.
- C. Expansion joints shall be provided where walks abut a structure, at changes in directions, and at intervals of not more than 50 feet. Expansion joints shall be filled to within one inch of the surface with bituminous expansion joint material, and then filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.
- D. Concrete walks shall be edged and grooved, with the grooves dividing each walk into equal length sections approximately equal to the width of the walk. Walks shall be floated smooth and even, and given a light broom finish at right angles to the length of the walk.

### 3.03 CONCRETE PAVEMENT

- A. Concrete Pavement, including driveways shall be replaced at locations designated by the Engineer with seven (7)-inch thick, reinforced concrete placed on six (6)-inch compacted base course.
- B. If an expansion or scored joint is within six (6) feet of the edge of the trench, the existing concrete shall be removed and replaced to the joint.
- C. The alignment of the new surface shall match that of the existing surface unless otherwise directed.
- D. The alignment and grade of the new surface shall match that of the existing surface unless otherwise directed.
- E. Expansion joints shall be filled to within one (1) inch of the surface with bituminous expansion joint material. Dowels shall be placed across the expansion joint at maximum 24" spacings.
- F. Contraction joints shall be provided at intervals of not more than ten (10) feet. Contraction joints shall consist of a groove of at least one third (1/3) the depth of the pavement sawed in green concrete or a plane of weakness formed by inserting a removable metal template.
- G. All expansion and contraction joints shall be filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.

H. Reinforcement shall consist of #4 deformed rebar placed at 24" OC both directions.

### 3.04 CONCRETE CURB AND GUTTER OR STRAIGHT GUTTER

- A. Curb and gutter shall be replaced to the thickness, geometric design, and alignment of the existing section with non-reinforced concrete on a 6-inch compacted gravel base course.
- B. In the event a joint is encountered within 5 feet of a proposed edge of the trench, the concrete shall be removed to such joint.
- C. Expansion joints shall be placed at changes in direction and at intervals not greater than 50 feet. Expansion joints shall be 1/2 inch wide, filled to within one inch of the surface with bituminous expansion joint material cut to the shape of the curb section. Dowels shall be placed across expansion joints as shown on the drawings or as directed.
- D. Contraction joints shall be provided at intervals of not more than 10 feet. Contraction joints shall consist of a groove at least 1-1/4 inches deep sawed in the green concrete or a plane of weakness formed by inserting a removable metal template.
- E. All expansion and contraction joints shall be filled flush to the surface with joint sealing compound. The joint sealing compound shall be finished slightly concave, and shall not be allowed to overflow the joint.
- F. All exposed edges of curbs and gutters shall be rounded with a suitable edging tool. Exposed surfaces shall be finished smooth and even with a steel trowel, and then given a light broom finish.

### 3.05 CONTRACTOR'S RESPONSIBILITY

- A. Any repaired areas which will include surface material and/or seeding requiring further repair due to trench settlement shall be repaired by the Contractor at his expense for a period of one year after written final acceptance of the project by the Owner.

\* \* \* END OF SECTION \* \* \*



## **SECTION 329219 SEEDING**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Soil preparation.
- B. Seeding, mulching and fertilizer.
- C. Erosion Control.
- D. Turf establishment.

#### **1.02 RELATED REQUIREMENTS**

- A. Section 312200 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

#### **1.03 DEFINITIONS**

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Growing Season: A growing season is considered May 1 to October 1.
- C. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- D. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- E. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil or imported topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

#### **1.04 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
- B. Certification of grass seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- C. Product tags to confirm quantity installed of the following products. Payment will not be approved until product tags have been received and approved by the Architect.
  - 1. Seed.
  - 2. Fertilizer.
  - 3. Fiber Mulch.
- D. Qualification Data: For qualified Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact person.
  - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site
  - 2. Pesticide Applicator: State licensed, commercial.
- E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and grasses during a calendar year. Submit before expiration of required initial maintenance periods.

- F. Establishment Plan. Describing an understanding of the required establishment period including anticipated dates for mowing, pest control, observation and overseeding.

#### **1.05 QUALITY ASSURANCE**

- A. Installer's Field Supervision: Require installer to maintain an experienced full-time supervisor on Project site when work is in progress.
- B. Pre-installation Conference: Schedule a pre-installation meeting to review soil preparation and grading with the Contractor and Architect prior to seeding.
- C. Seasonal limitations have been designated below. If seasonal limitations cannot be met, then an alternate soil stabilization practice must be used. Payment will be made to the Contractor for these alternate stabilization practices if caused by the conditions out of the Contractor's control and not the result of the Contractor's negligence or inability to keep the Project on schedule.
  - 1. Spring: April – June 15
  - 2. Fall: August 15 –September 15
  - 3. Dormant: November 1 – Freeze Up

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

### **PART 2 PRODUCTS**

#### **2.01 SEED MIXTURE**

- A. Seed Mixture - Turf:
  - 1. Millborn Seed "Tough Play", or approved equal, proportioned by weight as follows:
    - a. 90 percent Elite Tall Fescue.
    - b. 10 percent Elite Kentucky Bluegrass

#### **2.02 ACCESSORIES**

- A. Microbial Inoculant
  - 1. Inoculate seed prior to planting at rate recommended by manufacturer for seed type specified.
- B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
- C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.
- D. Commercial Fertilizer: All natural slow release nitrogen fertilizer:
  - 1. Sustane Natural Fertilizer, Inc., or approved equal.
    - a. Product: Sustane 4-6-4, or approved equal.
- E. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.
- F. Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- G. Erosion Fabric: excelsior fibers manufactured from aspen matting, open weave.
  - 1. Curlex II CL
    - a. American Excelsior Company
    - b. [www.curlex.com](http://www.curlex.com)
  - 2. Excel SS-2

- a. Western Excelsior Corporation
  - b. [www.westernexcelsior.com](http://www.westernexcelsior.com)
- 3. SB150
  - a. North American Green
  - b. [www.nagreen.com](http://www.nagreen.com)
- 4. Equal as approved by SD DOT for Type 2 Erosion Control Blanket.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

### **3.02 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Seedbed Preparation
  - 1. Kill existing weed growth with non-selective herbicide a minimum of two weeks prior to planting date. Apply a second application as necessary a minimum of 24 hours prior to seeding or sodding.
    - a. Apply at rate recommended by manufacturer.
  - 2. Loosen soil to a depth of 4-inches.
  - 3. Remove stones larger than 1-1/2 inches. in any dimension and sticks, roots, trash, and other extraneous matter.
    - a. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- E. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### **3.03 FERTILIZING**

- A. Incorporate fertilizer into the topsoil at the following rate:
  - 1. 10 lb/1,000 sf
- B. Fertilizer not required in native grass seed areas.
- C. Apply after smooth raking of topsoil and prior to roller compaction.
- D. Apply fertilizer no more than 48 hours prior to seeding.



- E. Mix thoroughly into upper 2 inches of topsoil.

### **3.04 SEEDING**

- A. The specified seed mixture shall be uniformly drilled using a press drill equipped with individually mounted, adjustable, spring loaded, double disk furrow openers fitted with depth control bands or drums.
  - 1. Utilize drill with a fluffy-seed box for native grass seeding.
- B. Seed Rates:
  - 1. Turf: 9lb per 1,000 sq ft.
- C. Hydroseeding is not permitted.
- D. Do not seed areas in excess of that which can be mulched on same day.
- E. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- F. Roll seeded area with roller not exceeding 112 lbs.

### **3.05 MULCHING**

- A. Fiber Mulch: Rate of application shall be 3,000 pounds per acre. Areas of excessive thickness of mulch, which will smother grass seedlings, shall be avoided. Mulch shall be placed on a given area as soon as possible or within 48 hours after seeding as a separate operation. The Contractor shall allow the fiber mulch to cure a minimum of 18 hours prior to watering.

### **3.06 EROSION CONTROL BLANKET**

- A. The extent of erosion control blankets shall be as shown on drawings.
- B. Lay fabric smoothly on surface, bury top end of each section in 6 inch deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- C. Orient erosion control blankets in vertical strips and anchored with staples, at spacing as indicated by manufacturer's written instruction for project application.
- D. Provide 12 inch overlap of adjacent rolls, anchor with a common row of staples.
- E. Overlap horizontal joints between erosion control blankets sufficiently to accommodate a common row of staples with the uphill end on top of the blanket below.
- F. Where exposed to overland sheet flow, bury top end of each section in 6 inch (150 mm) deep excavated topsoil trench. Staple the erosion control blanket to the bottom of the trench. Backfill and compact the trench as required.
- G. Secure outside edges and overlaps at 36 inch intervals with stakes.
- H. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

### **3.07 ESTABLISHMENT**

- A. Provide maintenance during establishment period at no extra cost to Owner.
- B. Begin maintenance immediately after each area is planted and continue until grass is well established and exhibits a vigorous growing condition free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 12-inches by 12-inches, **but not less than 120 days from date of Project Substantial Completion.**
  - 1. When maintenance period has not elapsed before the end of the growing season, or if turf is not fully established, continue maintenance during next growing season.
  - 2. Notify the Architect in writing upon the termination of required maintenance services. The Contractor shall continue maintenance services until written notification is provided.
- C. Maintain as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Materials and installation methods shall be the same as those used in the original installation.
  - 1. Fill and establish turf in areas where settling occurs.

2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards
- D. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. The contractor is required to mow all seeded turf areas one time. Document and notify the Architect and Owner in writing upon completion.
1. Neatly trim edges and hand clip where necessary.
  2. Immediately remove clippings after mowing and trimming.
- E. Watering: Where an irrigation system will be installed, maintain the irrigation program to keep turf uniformly moist to a depth of 4 inches. The Contractor may obtain water from Owner's existing water system for use without metering and without payment of use charges. If seeding is performed within the specified seeding windows watering is not required in areas where an irrigation system is not present.
1. Schedule irrigation to prevent wilting, puddling, erosion, and displacement of seed or mulch.
  2. Apply water with irrigation system at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- F. Roll surface to remove minor depressions or irregularities.
- G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
1. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
  2. Broadleaf herbicide application:
    - a. Turfgrass: apply a broadleaf herbicide application once turf is established, or as directed by Architect, when grass is dry.
- H. Immediately reseed areas that show bare spots.
- I. Protect seeded areas with warning signs during maintenance period.
- J. Turf Post-fertilization: Apply second fertilizer application at the end of the maintenance period, or as directed by Architect, when grass is dry. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

### **3.08 CLEANUP AND PROTECTION**

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- C. Remove nondegradable erosion-control measures after grass establishment period.

### **END OF SECTION**

## **SECTION 329300 PLANTS**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Planting soil preparation.
- B. New trees, plants, and ground cover.
- C. Mulch and Fertilizer.
- D. Weed-control barriers.
- E. Plant establishment.
- F. Tree Pruning.

#### **1.02 DEFINITIONS**

- A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Growing Season: A growing season is considered to be May 1 to October 1.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil or imported topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

#### **1.03 REFERENCE STANDARDS**

- A. ANSI/AHIA Z60.1 - American National Standard for Nursery Stock 2014.
- B. ANSI A300 Part 1 - American National Standard for Tree Care Operations -- Tree, Shrub and Other Woody Plant Maintenance -- Standard Practices 2017.

#### **1.04 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. Mulch
  - 2. Edging
  - 3. Weed Barrier Fabric
- B. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.
  - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to project site.
  - 2. Pesticide Applicator: State licensed, commercial.
- C. Maintenance Agreement: Statement of required maintenance period, duties to be performed, name and contact information of individual responsible for overseeing maintenance services.

- D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.
- E. Statement of Warranty. Describing an understanding of the required warranty. Provide name and phone number for responsible contact.

#### 1.05 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
- B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- C. Pre-installation Conference: Schedule a pre-planting meeting to review preparation and planting requirements with the Architect and Contractor prior to planting. All plants, trees and shrubs shall be planted in accordance with all the drawings and specifications included in the plans.
  - 1. Plant one (1) sample tree for review to demonstrate an understanding of Project requirements. Provide 48 hours' notice to Landscape Architect for planting approval prior to proceeding with remaining tree planting.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- B. Protect and maintain plant life until planted.
  - 1. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.
  - 2. Handle planting stock by root ball.
  - 3. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
  - 4. Trees may not be stored on site for more than 24 hours prior to planting without prior approval and installation of moisture retaining cover or bedding around all root balls.

#### 1.07 WARRANTY

- A. Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship or growth within the specified warranty period.
- B. Failures include, but are not limited to: death and unsatisfactory growth, lack of adequate maintenance and damage from falling or blowing over. The Contractor will be responsible to remove all dead plantings and trees immediately upon notification from the Architect, even if the replacement is not immediate. This requirement applies during the warranty period as well.
- C. All plants, trees and shrubs shall be **warrantied for ONE YEAR from date of Project Substantial Completion**. At the end of the warranty period the Architect shall make an inspection of the project and dead, unhealthy, or otherwise not acceptable plants, trees, and shrubs shall be replaced by the Contractor at no additional cost to the Owner.
  - 1. Notify the Owner and Architect in writing immediately upon completion of any warranty replacement plantings. For replacements after the initial establishment period has expired the Contractor shall water replacement plants for one week, after which the Owner assumes responsibility for watering replacement plants. If written notice is not provided the Contractor shall continue to water replacement plants until notice requirements are fulfilled.
  - 2. An intermediate warranty inspection may occur prior to the one year warranty expiration. Replacement is required within 60 days of the intermediate warranty inspection.

- a. If a plant replaced during the intermediate warranty period dies prior to the final warranty the contractor is not required to install a second replacement without additional compensation. Requests for additional compensation must be approved prior to proceeding with the work.
3. Notify the Architect in writing with any concerns regarding Owner Maintenance of plant material during the warranty period.

## **PART 2 PRODUCTS**

### **2.01 PLANTS**

- A. Plants: Species and size identified in plant schedule, grown in climatic conditions similar to those in locality of the work.
- B. General: All plants, trees and shrubs shall conform to or exceed minimum quality standards as defined by the American Nursery and Landscaping Association, current edition of ANSI Z60.1, and shall be purchased from a licensed Landscape Nursery. Plants, trees and shrubs furnished shall be of the same genus, species, cultivar and size as specified in the plans. Species and variety may be substituted only by the approval of the Landscape Architect. Each plant, tree and shrub shall have an identification label, removed after the Substantial Completion inspection.
- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

### **2.02 SOIL AMENDMENT MATERIALS**

- A. Commercial Fertilizer: All natural slow release nitrogen fertilizer:
  1. Composition: 8-2-4.
  2. Suggested supplier: Sustane Natural Fertilizer, Inc., or approved equal.
    - a. Product: Sustane 8-2-4, or approved equal.
    - b. Phone: 800-352-9245
    - c. Web: [www.sustane.com](http://www.sustane.com)
  3. Application rate: 10 lb/1000 SF
- B. Compost: Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from: agricultural, food, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; source-separated or mixed solid waste. The product shall contain no substances toxic to plants and shall be reasonably free (< 1% by dry weight) of man-made foreign. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived. The product shall be certified through the U.S. Composting Council's (USCC) Seal of Testing Assurance (STA) Program.

### **2.03 MULCHED**

- A. Rock Mulch: Rounded riverbed gravel or smooth-faced stone.
  1. Size Range: Uniformly graded; 2 inches maximum, 1 inch minimum.
  2. Color: Readily available natural gravel color range.
- B. Organic Mulch: Shredded bark mulch.
  1. Color: undyed natural wood.
  2. Particle size and consistency: a general mixture of fibers 3 inches in length or less.
  3. Remove any large mulch chunks that do not meet the requirements above.

### **2.04 LANDSCAPE EDGINGS**

- A. Plastic Edging: Standard black polyethylene or vinyl edging, V-lipped bottom grooved, extruded in standard lengths, with 9-inch steel angle stakes.
  1. Basis-of-Design Valley View Industries Black Diamond, or approved equal.
    - a. Edging Size: 0.1 inch wide by 5 inches deep.
    - b. Top Profile: Round top, 1 inch in diameter.
    - c. Accessories: Manufacturer's standard alignment clips or plugs.

## **2.05 WEED-CONTROL BARRIERS**

- A. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric.
  - 1. Basis-of-Design: DeWitt Pro 5, or equal as approved by addendum prior to bid.

## **2.06 PESTICIDES**

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
- B. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.
- C. Pre-Emergent Herbicide: Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

## **2.07 TREE WATERING BAG**

- A. Treegator slow release watering bag, or approved equal; [www.treegator.com](http://www.treegator.com)
  - 1. Size: 20 Gallon
  - 2. Supply and install one per tree.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
  - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  - 4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

### **3.02 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
- B. Prepare surface soil:
  - 1. Kill existing weed growth with non-selective herbicide a minimum of two weeks prior to planting date. Apply a second application as necessary a minimum of 24 hours prior to planting.
    - a. Apply at rate recommended by manufacturer.
  - 2. Loosen surface soil to a depth of at least 6 inches.
  - 3. Remove stones larger than 1-1/2 inches. in any dimension and sticks, roots, trash, and other extraneous matter.
    - a. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
  - 4. Incorporate compost into the top 6 inches of plant bed soil.
    - a. Apply at a rate of 4 cubic yards per 1,000 sq ft.

- C. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

### 3.03 FERTILIZING

- A. Apply fertilizer in accordance with manufacturer's instructions.
- B. Apply after initial raking of topsoil.
- C. Mix thoroughly into upper 2 inches of topsoil.

### 3.04 TREE AND SHRUB PLANTING

- A. Place plants as indicated.
- B. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.
  - 1. Expose root flare; root flare may have been buried in the root ball during growing or tree harvesting operations.
- C. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- D. Excavate planting pits with sides sloping inward at a 30-degree angle. Excavations with vertical sides are not acceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
  - 1. Excavate approximately five times as wide as ball diameter.
  - 2. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
  - 3. Hand dig tree planting pits when in close proximity to existing utilities.
- E. Set stock plumb and in center of planting pit or trench with **root flare 1 inch above adjacent finish grades.**
  - 1. Use planting soil for backfill.
  - 2. Balled and Burlapped: After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
  - 3. Container-Grown: Carefully remove root ball from container without damaging root ball or plant.
  - 4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
  - 5. Continue backfilling process. Water again after placing and tamping final layer of soil.
- F. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.
- G. Set plants vertical.
- H. Remove non-biodegradable root containers.

### 3.05 PLANT SUPPORT

- A. Trunk stabilization is not required unless deemed necessary by the Architect to maintain the tree in an upright position. Tree staking may be requested at any time between planting and expiration of the plant warranty period.

1. Upright Staking and Tying: Use three stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

### **3.06 TREE PRUNING**

- A. Prune trees as recommended in ANSI A300 Part 1.
- B. Prune newly planted trees as required to remove dead, broken, and split branches.

### **3.07 PERENNIAL AND ORNAMENTAL GRASS PLANTING**

- A. Set out and space perennial plants and ornamental grasses according to plan and in even rows with triangular spacing.
- B. Use planting soil for backfill.
- C. Dig holes large enough to allow spreading of roots.
- D. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
- E. Water thoroughly within two hours after planting, taking care not to cover plant crowns with wet soil.
- F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

### **3.08 PLANT BED EDGING**

- A. Plastic Edging:
  1. Dig 4 inch deep trench along lawn edge. Sink edging into trench with the 'V' lip facing the plant bed.
  2. Secure edging with a stake every 5 feet at a 45 degree angle. The stake shall not be installed higher than 2" above the 'V' lip.
  3. For connecting two sections of edging together, cut five inches from one of the sections of bead. Overlap and use the provided connector when joining two lengths of edging together. Secure with stake through overlap.

### **3.09 PLANTING AREA MULCHING (SHREDDED HARDWOOD)**

- A. Mulch backfilled surfaces of planting areas and other areas indicated.
  1. Trees in Turf Areas: Apply organic mulch ring of 4-inch average thickness, with 5 foot minimum diameter around trunks or stems or 12-inches outside dripline of evergreen trees. Do not place mulch within 3 inches of trunks or stems.
  2. Apply pre-emergent herbicide according to manufacturer's written instruction.

### **3.10 PLANTING AREA MULCHING (ROCK MULCH)**

- A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.
- B. Apply 3-inch average thickness of rock mulch as indicated on plan over whole surface of planting area, and finish level with adjacent finish grades.
  1. Place organic mulch ring around each individual plant or shrub.
  2. Do not place rock mulch within 3 inches of trunks or stems.

### **3.11 ESTABLISHMENT**

- A. Provide maintenance during establishment period at no extra cost to Owner.
- B. Maintain plant life for 45 days from date of Project Substantial Completion.
  1. **During the establishment period the Contractor shall be on site a minimum of one hour per week throughout the maintenance period to monitor plants, water, adjust irrigation, and weed as necessary.**



2. When maintenance period has not elapsed before the end of the growing season continue maintenance during the next growing season.
  3. Notify the Architect in writing upon termination of the required maintenance services. The Contractor shall continue maintenance services until written notification is provided.
- C. Irrigate sufficiently to saturate root system and prevent soil from drying out.
  - D. Remove dead or broken branches and treat pruned areas or other wounds.
  - E. Neatly trim plants where necessary.
  - F. Immediately remove clippings after trimming.
  - G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions.
  - H. Control insect damage and disease. Apply pesticides in accordance with manufacturers instructions. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
  - I. Remedy damage from use of herbicides and pesticides.
  - J. Replace mulch when deteriorated or displaced.
  - K. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

**END OF SECTION**

# **DIVISION 33 – UTILITIES**

**SECTION 33 01 00 EXISTING UNDERGROUND UTILITIES**

**SECTION 33 31 00 SANITARY SEWER PIPING AND FITTINGS**

**SECTION 33 39 13 MANHOLES AND CASTINGS**

**SECTION 33 41 00 STORM UTILITY DRAINAGE PIPING**



# **SECTION 33 01 00**

## **EXISTING UNDERGROUND UTILITIES**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the contract, including General and Supplementary Conditions shall apply to the Work covered in this Section.

#### **1.02 SCOPE**

- A. This Section describes, but is not limited to, the relationship of the Project to existing underground utilities and the Work associated with the location, adjustment, and repair of underground utilities.
- B. The information and data relative to existing underground utilities are provided to assist the Contractor with the preparation of his bid. This information should not be used by the Contractor for reference during construction of the Work.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION**

#### **3.01 GENERAL**

- A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by each Contractor as the Work proceeds. Excavation work shall be done carefully so as to avoid damaging the existing utilities and Work.
- B. Each Contractor shall provide for protection, temporary removal and replacement or relocation of obstructions as required for the performance of this Work required in these contract documents.
- C. Other obstructions not shown on the plans and requiring relocation shall be exposed by the Contractor without injury; or if injured, shall be repaired by Contractor at his expense. Removal of such obstruction or its relocation shall be made by the Contractor according to the provisions of the General Conditions.

#### **3.02 UTILITY CONTACT**

- A. Prior to Work in a specific area affecting underground utilities, the following individuals shall be notified as appropriate:
- B. All above utilities, excepting water, may be located utilizing the South Dakota One Call Notification Center:

(Locate Phone Number) 1-800-781-7474

(Admin. Phone Number) 1-800-422-1242

- C. The failure of any utility to be present for any reason, at the Pre-Construction Conference, if held, shall not relieve the Contractor of any responsibility described herein.

### 3.03 UTILITY REPAIR:

- A. When an underground utility is exposed or damaged, the Contractor shall comply with the repair requirements of the affected utility.
- B. When an underground utility is exposed, the Contractor shall compact the backfill beneath the exposed utility before completion of the backfill operation.

### 3.04 SANITARY/STORM SEWER AND WATER MAIN SEPARATION:

- A. Horizontal Separation - Sewers shall be laid at least 10 feet (3.0 m) horizontally from any existing or proposed watermain. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot (3.0 m) separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the sewer closer to a watermain, provided that the watermain is in a separate trench or on an undisturbed earth shelf located on one side of the sewer and at an elevation so the bottom of the watermain is at least 18 inches above the top of the sewer.
- B. If it is impossible to obtain proper horizontal separation as described above, both the watermain and sewer shall be constructed of slip-on or mechanical joint pipe complying with public water supply design standards of the Department and be pressure tested in accordance with AWWA standards to assure water tightness before backfilling.
- C. Vertical Separation
  - 1. Sewers Crossing Under Watermains - The sewer shall be laid to provide a minimum of 18 inches from the top of the sewer to the bottom of the watermain. The crossing shall be arranged so the sewer joints will be equidistant and as far as possible from the watermain.
  - 2. Sewers Crossing Over Watermains - Either the watermain or the sewermain must be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.
  - 3. Special Conditions - When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, one of the following methods shall be specified:
  - 4. Water Pipe - The sewer shall be designed and constructed equal to water pipe and shall be pressure tested in accordance with AWWA standards prior to backfilling to assure water tightness; or;
  - 5. Carrier Pipe - Either the watermain or the sewermain may be encased in a watertight carrier pipe that extends 10 feet (3.0 m) on both sides of the crossing, measured perpendicular to the watermain. The carrier pipe shall be PVC, ABS, or HDPE, and the ends sealed with a rubber gasket or boot.
- D. Storm Sewer Requirements:
  - 1. A reinforced concrete pipe (RCP) storm sewer may cross below a watermain with a separation of less than 18 inches or at any height above a watermain provided the joints

on the RCP within 10 feet of either side of the watermain are assembled with:

2. Preformed butyl rubber sealant meeting federal specification #SS-S-210A and AASHTO M 198, and each of these joints are encased with a minimum 2-foot wide by 6-inch thick concrete collar centered over the joint and reinforced with the equivalent steel area as that in the RCP. Encasement of the watermain will not be required when the RCP joints are collared within the 20-foot section.
  3. An O-ring that conforms to ASTM C 443 specifications. O-rings are manufactured for concrete pipe with diameters up to 18 inches.
  4. A strip of impermeable material held in place with stainless steel bands and tested to 5 psi prior to the storm sewer being put into use.
- E. There shall be at least a 10-foot horizontal separation between watermains and sanitary sewer forcemains. There shall be an 18-inch vertical separation at crossings as required in paragraphs B and C.

#### **PART 4 MEASUREMENT AND PAYMENT**

##### **4.01 METHOD OF MEASUREMENT**

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate measurement made.

##### **4.02 BASIS OF PAYMENT**

- A. The cost to repair any underground utilities or other obstructions damaged by the Contractor's activities shall be considered incidental Work with no separate and payment to be made.

\* \* \* END OF SECTION \* \* \*

# **SECTION 33 31 00**

## **SANITARY SEWER PIPING AND FITTINGS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.
- B. Related Work Specified Elsewhere:
  - 1. Trenching, Backfilling and Compacting - Section 31 23 33
  - 2. Sanitary Sewer Gravity Pipe Cleaning - Section 33 01 30.12
  - 3. Standard Drawing: 33 31 00

#### **1.02 DESCRIPTION OF WORK**

- A. The work covered under these specifications shall include the furnishing of all labor, material, tools, and equipment necessary to furnish and install, complete in place, all piping and fittings as shown on the drawings and as specified herein.

#### **1.03 SUBMITTALS**

- A. The Contractor shall submit for review shop drawings for materials specified herein as hereinafter specified.
- B. Certificates from the manufacturer that the materials meet or exceed specified requirements.
- C. The manufacturer's installation recommendations, including types and amounts of gasket lubricant, where applicable, to be used.

#### **1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. All materials shall be packed, loaded, transported, unloaded, and handled in such a manner so as to prevent damage to the materials.
- B. All material shall be loaded and unloaded by lifting with slings or hoists or skidding so as to avoid shock or damage. Dropping or rolling will not be permitted. The use of end hooks to install or move piping will not be allowed.
- C. All materials shall be stored on the site in accordance with the manufacturer's recommendations. Do not store materials directly on the ground.
- D. All materials shall be kept clean and dry. The insides of all piping and fittings shall be kept free of dirt and debris.

### **PART 2 PRODUCTS**

#### **2.01 DUCTILE IRON FITTINGS**

- A. Ductile iron fittings shall conform to the requirements of ANSI/AWWA C110 &



C153/A21.10 & A21.53.

- B. Ductile Iron Fittings to be installed underground shall be mechanical joint or push-on joint type conforming to the requirements of ANSI/AWWA C 111/A 21.11.
- C. Ductile Iron Fittings to be installed in "non-buried" locations shall be provided with flanged joints with rubber full-face gaskets. Flanged faces shall be drilled to standard 125-pound template unless otherwise noted.
- D. All Ductile Iron Fittings shall be lined with cement mortar in accordance with ANSI/AWWA C104/A21.4 the exterior finishes shall be an asphaltic varnish coating not less than 1 mil thick.

## 2.02 GRAVITY PVC PIPE

- A. Polyvinyl Chloride (PVC) gravity pipe shall be Type I, Grade I, conforming to the requirements of ASTM Specification D 3034 for Rigid Poly (Vinyl Chloride) Sewer pipe.
- B. Solvent Cement for PVC pipe joints shall conform to ASTM Specification ASTM D 2564 and shall be applied in conformance with ASTM D 2855. Solvent weld joints will be allowed on PVC cleanout risers only.
- C. Gasket type joints shall be made with rubber gaskets conforming to the requirements of ASTM F-477.
- D. The pipe shall be capable of withstanding trench loads imposed on it.

## 2.03 GRAVITY PVC PIPE FITTINGS

- A. Repair couplers, tees, wyes, and bends for Polyvinyl Chloride (PVC) gravity pipe fittings shall be of PVC with material and dimensions conforming to the requirements of ASTM Specification D 3034.
- B. Gaskets for elastomeric joints shall conform to the requirements of ASTM F-477.
- C. Solvent Cement for solvent weld joints shall conform to the requirements of ASTM Specification D 2564 and shall be applied in conformance with ASTM D 2855. Solvent weld joints will be allowed on PVC cleanout risers only.
- D. Sewer "Wyes" for service connections shall be in-line sewer wyes. Saddle wyes will not be permitted for use without permission from Project Engineer.

## 2.04 TRANSITION COUPLINGS (PRESSURE PIPING)

- A. The couplings used for transitions between piping of different materials shall be a wide-range flexible coupler with a sleeve type design meeting the requirements of AWWA C219.
  - 1. The coupling body shall be a center sleeve fabricated of high strength carbon steel tubing equivalent to ANSI/AWWA C200. The transition couplers will be readily available in nominal diameter ranges from 1.5 to 24 inches on all pipe classes.
  - 2. Compression End Rings: One gasket compression end ring per coupling end. End rings to be of either one or two bolt design, fabricated of carbon steel equivalent to ASTM A576. (One bolt per end in Nominal Size ranges of 2 to 12 inches and two bolts per end on the 16 to 24 inch nominal diameter coupling.)
  - 3. Hydraulic Wide Range Gasket: Chloramine Resistant NSF-61 approved EPDM gasket

designed with a multi-layered wide range removable outer layer. Gasket hydraulically actuated with a pressure-equalizing dam, pressure cavity and sealing lip for working pressure of 260 psi (1.5 to 16 inches) and 232 psi (18 to 24 inch nominal diameter coupling).

4. Fasteners shall be grade 304 (A2) or 316 (A4) stainless steel with yield strengths that conform to all nationally recognized standards. Bolts to be coated with an anti-seize type coating to prevent galling.
  5. The interior and exterior coatings shall NSF-61 approved fusion bonded epoxy coating conforming to AWWA C213.
  6. When properly installed the coupling will provide a minimum deflection of 8 degrees, up to 260 psi working pressure and 3/8 inch longitudinal pipe movement without leakage. (Flanged adapters will provide half the longitudinal movement and deflection.)
  7. All products will be proof tested to a minimum of 1.5 times working pressure.
- B. Flanged couplers shall consist of one compression end and gasket, coupling center sleeve, and AWWA Class "D" Flange (per AWWA C207).
- C. Pre-Approved transition couplers are: Hymax-2000 Series wide range coupling; Hymax-2100 Series wide range flanged coupling adapter; "Macro" extended range coupling by Romac Industries, Inc.; or Engineer approved equal.

## 2.05 TRANSITION COUPLINGS (GRAVITY PIPING)

### A. GASKET

1. Manufactured to meet the material requirements of:
  - a. CSA B602 - mechanical couplings for drain, waste, vent pipe and sewer pipe
  - b. ASTM D 5926 - Standard Specification for Poly Vinyl Chloride (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
  - c. ASTM C 1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems
  - d. Hardness, Shore"A", Inst. +5.....65
  - e. Tensile Strength, Min. psi .....1000
  - f. Elongation at Rupture, Min. %.....250
  - g. Tear Strength, Min..... 150 lb/in.
  - h. Brittleness Temperature..... -40°F

### B. CLAMPS

1. Manufactured to the requirements of CSA B602
2. Clamp Housing- 301 Stainless Steel
3. Clamp Band - 301 Stainless Steel
4. Clamp Screw - 305 Stainless Steel

5. Installation torque 60" lbs

C. SHEAR RING

1. 0.012" Thick, 300 Series Stainless Steel
2. Width manufactured according to coupling width (1.50", 2.13", or 4")
3. Length manufactured according to coupling diameter
4. Clamps spot welded in place

D. COUPLING

1. Manufactured to conform to the performance requirements of:
  - a. ASTM C 1173 - standard specification for flexible transition couplings for underground piping systems
  - b. CSA B602 - mechanical couplings for drain, waste, vent pipe and sewer pipe
  - c. Maximum test pressure: 4.3 PSI (29.6KPA)
  - d. Maximum operating temperature: 140° F nonconsistent

- E. Pre-Approved transition couplers are Strong Back RC Series Repair Couplings manufactured by Fernco Inc. or Engineer approved equal.

2.06 BEDDING MATERIAL

- A. Borrowed granular bedding material shall conform to the gradation indicated below.

<u>Sieve Opening</u>	<u>Bedding Material (Percent Passing)</u>
1"	95-100
No. 200	< 15

- B. Borrowed granular bedding material for unstable trench bottom shall conform to the gradation indicated of size 67 Course Aggregate, ASTM C33 which is indicated below.

<u>Sieve Opening</u>	<u>Bedding Material (Percent Passing)</u>
1-1/2"	100
3/4"	90-100
3/8"	20-55
No. 4	0-10
No. 8	0-5

- C. Bedding material excavated from the job site shall be finely divided material free from organic material and clods, lumps of frozen material or stones larger than 1 1/2" in maximum diameter. Bedding material shall be of proper moisture content to form a firm bed for the pipe.

2.07 FASTENERS

- A. All fasteners in buried locations shall be Grade 304 (A2) or Grade 316 (A4) stainless steel. Anti-Seize shall be applied to all threads prior to installation.

## 2.08 LUBRICANT FOR GASKETED PIPE

- A. Lubricant shall be an emulsified polymer based product, specifically formulated to be water-soluble without causing turbidity. Lubricant shall not transfer taste and/or odor to new water main installations. Lubricant must not promote bacterial growth and be safe for use on all metal and plastic pipes. Lubricant shall be easily flushed from the line and be non-reactive to chlorinated water. Lubricant should work easily on both wet and dry surfaces.

## 2.09 POLYETHYLENE WRAP

- A. All ductile fittings shall be wrapped with polyethylene plastic film having a minimum thickness of 0.008 inches or with a cross woven polyethylene plastic film having a minimum thickness of 0.004 inches.

# **PART 3 EXECUTION**

## 3.01 GENERAL

- A. The areas to receive piping shall be examined for defects that may adversely affect the execution and quality of Work. Prior to the start of piping installation, all measurements shall be checked for deviations from allowable tolerances for piping.

## 3.02 BURIED PIPING INSTALLATION

- A. All piping and fittings shall be laid true to line and grade as shown on the plans. Each section of pipe shall be so laid and fitted together that when complete the piping will have a smooth uniform flow line. The inside of all pipe shall be cleaned before installation and kept thoroughly clean during and after the laying. Pipe ends shall be cleaned inside and outside.
- B. Apply lubricant liberally to the inside of the pipe bell and spigot. Make sure lubricated surfaces remain free of dirt, gravel, or other debris. Assemble the pipe joint immediately after application of the lubricant.
- C. All pipe and fitting shall be examined for defects before being lowered into the trench. The interior and exterior protective coating shall be inspected and field repaired, if required.
- D. The pipe shall be handled and installed in accordance with manufacturer's recommendations and the requirements of AWWA C 600 for Ductile Iron pipe, ASTM D 2774 for PVC pressure piping and ASTM D 2321 for PVC gravity sewer piping.
- E. When pipe laying is not in progress, including the noon hours, the open ends of pipe shall be closed. No trench water, animals, or foreign material shall be permitted to enter the pipe.
- F. Class "C" Bedding shall be used with all piping. The bedding material shall conform to the requirements of Part 2 above. General requirements for placement are shown on Standard Drawing 333100-1. On all non-rigid piping, care will be taken to provide maximum support in the haunch area of the pipe. This area extends from the bedding material to the center of the pipe. If coarse materials with voids have been used for bedding materials, the same bedding materials will be used for haunching. When a trench box or similar device is used during excavation, the box will be raised sufficiently to recompact the haunch area in the natural trench to 97% maximum dry density as determined by ASTM D 698.
- G. After each pipe has been graded, aligned, and placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted

under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe joining and embedment operations.

- H. The pipe shall be laid upon properly placed bedding material so that the barrel of the pipe will have a bearing for its full length. No blocking will be allowed to bring the piping up to grade. Bell holes and depressions for joints shall be excavated after the trench bedding has been graded to provide uniform support for the entire pipe.
- I. The Contractor shall provide and maintain all necessary means and devices at all times to remove and dispose of all water entering the trench during the process of pipe laying. The trench shall be kept dry until the pipe laying and jointing are completed. Removal of water shall comply with Section 31 23 33.
- J. Thrust blocks or restraining fittings to restrain pressurized piping shall be provided at all abrupt changes in direction, tees, bends, dead ends and hydrants, and shall be in accordance with the pipe manufacturer's recommendations.
- K. The Contractor shall place backfill material in lifts not exceeding 1-foot and compact to 97% Standard Proctor Density. Stones equal to or larger than 3-inches in diameter shall not be placed within 2-feet of the pipe.

### 3.03 EXPOSED PIPING INSTALLATION

- A. Each item or system shall be furnished complete and installed as shown on the plans and in accordance with the manufacturer's recommendations, instructions, and directions. All installed equipment and systems shall be properly protected during subsequent construction operation.
- B. The Contractor shall inspect all material or equipment as it is received to determine damage and/or missing parts. It shall be his responsibility to repair or replace damaged items in accordance with the manufacturer's instructions.
- C. The Contractor shall provide all scaffolding required for the proper installation of this work in conformance with the standards of any local and state safety codes applying to scaffolding.
- D. All pipe shall be set such that the vertical and horizontal centerlines are properly aligned. Installation of piping by means of springing, forcing or stressing the pipe or adjacent fittings, valves or equipment will not be allowed.

### 3.04 MECHANICAL JOINTS AND COUPLINGS

- A. Mechanical joints shall be carefully assembled in accordance with the manufacturer's recommendations. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled or replaced. Over tightening bolts to compensate for poor installation practice will not be permitted.
- B. The holes in mechanical joints with tie rods shall be carefully aligned to permit installation of the tie rods. In flange and mechanical joint pieces, holes in the mechanical joint bells and the flanges shall straddle the top (or side for vertical piping) centerline. The top (or side) centerline shall be marked on each flange and mechanical joint piece at the foundry.

### 3.05 TRACER WIRE INSTALLATION

- A. Tracer wire shall be installed in the trench at the same time as the pipe or immediately prior to starting the backfill of the trench.
- B. Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.
- C. Splices will be allowed at manholes, bored crossings, and at other locations as agreed upon by the Resident Project Representative. Splices in tracer wire will be made with split bolt or compression-type connectors. Wire nuts may not be used. A waterproof connection is necessary to prevent corrosion. Splices shall be completed in accordance with the manufacturer's recommendations.
- D. Prior to final acceptance, all tracer wire shall be electrically tested for continuity from one exposed end to another.
- E. Bring the wire to the ground surface at each manhole and boring ends and loop the wire in a tracer wire terminal box. These boxes shall be located adjacent to the manhole and/or bored crossing in the boulevard with at least two feet of extra wire inside the box. The tracer wire terminal box must be installed flush with the finished grade.

### 3.06 TESTING

- A. All piping shall be cleaned and flushed after completion of installation.

\* \* \* END OF SECTION \* \* \*



# **SECTION 33 39 13**

## **MANHOLES AND CASTINGS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions and the provisions of Division 1, Special Requirements apply to Work specified in this Section.
- B. Related Work Specified Elsewhere:
  - 1. Sheeting, Shoring and Bracing - Section 31 23 14
  - 2. Curbs, Gutters, Sidewalks and Driveways - Section 32 16 00
  - 3. Existing Underground Utilities - Section 33 01 00
  - 4. Sanitary Sewer Piping and Fittings – Section 33 31 00

#### **1.02 DESCRIPTION OF WORK**

- A. The Work covered under these specifications shall include the furnishing of all material, labor, tools, and equipment necessary to furnish, install, and construct complete in place all manholes as shown on the drawings and specified herein.
- B. When the term "manhole" is used in these specifications, it shall mean a structure that is placed on the sewer line to permit entry, inspection, cleaning, and repair of the sewer, and shall apply to all types of manholes whether standard, drop, flow measuring, or pond control.

#### **1.03 JOB CONDITIONS**

- A. Existing underground utilities, as shown on the drawings, are located in accordance with available data, but locations may vary and cannot be guaranteed. The exact locations shall be determined by the Contractor as work proceeds. Excavation work shall be done carefully so as to avoid damaging existing work.
- B. Contractor shall provide for protection, temporary removal and replacement or relocation of said obstructions as required for the performance of the work required in these contract documents.

#### **1.04 SUBMITTALS**

- A. The Contractor shall submit for review copies of shop drawings for the materials as specified.

### **PART 2 PRODUCTS**

#### **2.01 MANHOLES**

- A. Manholes shall be constructed of concrete or precast concrete with bases, rings, and covers according to the dimensions and details as shown on the plans or as called for in the specifications.



- B. The materials used shall conform to the following requirements:
1. Concrete shall conform to the requirements of Division 3 of these specifications.
  2. Concrete reinforcing shall be Class 60 and conform to the requirements of Division 3 of these specifications.
  3. Precast manhole sections and bases shall be of the class as shown on the drawings and shall conform to ASTM C-478.

## 2.02 CASTINGS

- A. Gratings and covers shall be of the standard design of the manufacturer. All castings shall be of uniform quality, free from blowholes, shrinkage, cracks, distortion, or other defects affecting strength and appearance. They shall be smooth and well cleaned.
- B. Metal used in the manufacture of castings shall conform to ASTM A48, Class 35B for gray iron or ASTM A536, Grade 65-45-12 for ductile iron.
- C. All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.
- D. All cast dimensions may vary 1/2 the maximum shrinkage possessed by the metal or plus or minus 1/16 inch per foot.
- E. All weights shall not exceed the manufacturer's published weights by plus or minus 5%.
- F. All castings shall exceed proof load requirements of 16,000 lbs. The proof load test results shall be furnished upon request. The proof load test procedure shall be in accordance with Federal Specification A-A 60005.
- G. Standard manhole castings and covers will provide a minimum 24.0 inches clear opening for access. Manholes will have a minimum height of 7.0 inches and a minimum base width of 35.25 inches. Manhole lids will be provided with a rubber gasket to provide a self-sealing water tight lid when installed. Lids will be furnished with concealed pick holes.
- H. Manhole castings listed on the plans as "Frost Retardant" will provide a minimum 22.0 inches clear opening for access. Manhole frame will have an inner lid to provide an air break to prevent frost. Inner lid will be furnished with a handle to easily remove inner lid. Manholes will have a minimum height of 7.0 inches and a minimum base width of 38.0 inches. Manhole outer lids will be provided with a rubber gasket to provide a self-sealing water tight lid when installed. Outer lids will be furnished with concealed pick holes.

## 2.03 LADDERS AND STEPS

- A. Steps when called for on the detailed drawings and specifications shall conform to the requirements shown thereon and as supplemented herein.
- B. Manhole Steps will have a minimum step width of 11.0" and have a minimum 5.75" projection from the wall.
- C. Steps will have copolymer polypropylene cover with 1/2 inch ASTM A615 Grade 60 Steel reinforcement. All steel will be powder coated as per ASTM A934.

## 2.04 MANHOLE WALL JOINT SEALANT

- A. Manholes will be constructed with flexible rubber joints meeting the requirements of C990, "Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants."
- B. It is also recommended, but not specifically required, that a flexible gasket material be used on each joint to insure sealing of manhole wall joints. Flexible sealants may be RAM-NEK as manufactured by Henry Company, Houston Texas; ConSeal as manufactured by Concrete Sealants, Inc., New Carlisle, Ohio; Polylok's Butyl Joint Sealant, Polylok, Incorporated, Wallingford, CT; or Engineer approved equal.
- C. **Under no conditions will spray foam insulation of any form or brand be used to seal manhole joints.**

## 2.05 MANHOLE WALL - CASTING SEALANT

- A. Unless otherwise shown on the plans, sealant material meeting the requirements of Paragraph 2.04-A above shall be used to make a watertight seal between the manhole wall and casting.
- B. When shown on the plans, the manhole wall - casting joint shall be sealed with an internal flexible rubber seal that conforms to the following requirements:
  - 1. The rubber sleeve shall have a minimum thickness of 3/16 inches. The rubber sleeve shall be corrugated to allow up to 2 inches of vertical and horizontal movement without stretching the material. The rubber sleeve shall have a minimum unexpanded vertical height of 6 inches. The rubber sleeve material shall have the physical properties as shown in Table I.

TABLE I - RUBBER SLEEVE

PHYSICAL PROPERTIES	
Tensile Strength	1200 psi
Elongation at break	350% min.
Hardness (Durometer)	45 \ 5
Accelerated oven aging	max. 15% decrease of tensile, 20% of elongation
Chemical resistance	no weight loss in 1N of sulfuric or hydrochloric acid
Compression set	25% maximum decrease
Water absorption	max. 10% increase by weight
Ozone resistance	rating 0
Low temperature brittle point	No fracture at -40 degrees C.
Tear resistance	200 lb. f/in.
Splice strength	180 degree bend with no visible separation

- 2. The expansion bands shall be one piece; channeled 16-gauge stainless steel with a minimum width of 1-1/4 inches. The bands shall have a minimum 10-inch long adjustment slot which shall provide a minimum of 2-1/2 inches of diameter range. The bands shall be locked in place by the tightening of 2 self-locking stainless steel studs.

- C. Manhole casting seals shall be an Internal Manhole Chimney Seal as manufactured by Cretex Specialty Products, or approved equivalent.

## 2.06 PIPE OPENING GASKET

- A. Unless otherwise shown on the plans, the pipe opening in the manhole wall shall be made watertight with a rubber gasket assembly meeting the requirements of ASTM C923 and the following:

### 1. GASKET:

#### Minimum Thickness of Gasket Material

8" Holes thru 16" Hole Sizes ----- 0.290" \ 0.025

18" Holes and Larger Hole Sizes ----- 0.300" \ 0.025

#### Minimum Compound Tensile

Strength of Rubber ----- 1,800 PSI

Elongation of Rubber ----- 450% - 550%

Shore A Durometer of Rubber ----- 42 \ 5

### 2. EXPANSION SLEEVE:

#### Type 304 Stainless Steel

Tensile Strength of Steel ----- 85,000 PSI

Yield Strength of Steel ----- 35,000 PSI

8" thru 26" Hole Sizes ----- 1.5" Wide 11-Gauge

28" Hole Sizes and Larger ----- 1.5" Wide 10-Gauge

### 3. TAKE UP CLAMPS:

#### Stainless Steel

Band, Saddle and Housing made of Type 302

Screw made of Type 305 Stainless Steel

## **PART 3 EXECUTION**

### 3.01 LOCATIONS

- A. Manholes shall be constructed at the locations and grades indicated on the plans.

### 3.02 GENERAL CONSTRUCTION

- A. Manholes shall be constructed only when the temperature is above 32 degrees F. All Work shall be protected against freezing.
- B. The bottom of the foundations shall be not lower than 12 inches below the lines of the invert of the sewer at that point and shall be included in the unit price bid for manholes.
- C. Invert channels shall be smooth, accurately shaped, and in accordance with the plan elevations. Invert channels may be formed directly in the concrete of the manhole base, may be formed using a section of PVC of required size and length as form material, and pouring concrete around same on top of the manhole foundation, may be built up of brick work and mortar, may consist of half tile laid in the concrete base, or may be constructed by laying full section sewer pipe straight through the manhole and cutting out the top half after the manhole floor is constructed and sufficiently set. The floor of the manhole shall be constructed in

such a manner as to drain into the invert properly.

- D. Manholes shall be built up so that the cover, when placed, will be at the grade required in the plans or as set by the Engineer.

### 3.03 PRECAST CONCRETE MANHOLES

- A. Monolithic precast concrete manholes shall be constructed in accordance with the details shown on the plans, as required by ASTM specification C478 and as specified hereinafter.
- B. Monolithic concrete and precast concrete manholes shall have offset cones; that is, one side shall be vertical.
- C. Precast base sections may be a base riser section and separate base slab or base section with integral floor. Cast in place bases shall be furnished as shown on the plans.
- D. Precast concrete manholes shall be placed using present acceptable construction methods.
- E. The openings in monolithic precast manhole sections shall be sealed using a rubber sleeve gasket to make a flexible watertight connection.
- F. All manhole sections shall be sealed with a double ring of sealant to form a watertight seal.
- G. All lifting holes in the manhole walls shall be carefully grouted with non-shrink grout prior to backfilling.

### 3.04 BACKFILLING

- A. After completion of footings, walls, and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation cleaned of all trash and debris.
- B. The Contractor shall protect the manhole from all elements and from displacement during backfill operations. If any displacement of a manhole occurs, the Contractor shall repair all resulting damage and return the manhole to the original position required at his own expense.

### 3.05 CASTING PLACEMENT

- A. The manhole casting and cover shall be carefully centered and sealed in the opening manhole wall-casting. Sealant methods and material as shown on the plans.
- B. When an internal or external manhole casting sleeve is required. The Contractor shall install seal according to Manufacturer's requirement. Care shall be taken to insure seal is not damaged during installation. Contractor shall replace any damaged seals at no cost to Owner if damaged during installation procedures.

### 3.06 SURFACE FINISH

- A. The surface of the area shall be finished and smoothed to the lines and grades as shown on the plans.
- B. The requirements for the surface finish of the surrounding area shall conform to the requirements of the specifications relating to the surface to be replaced.

\* \* \* END OF SECTION \* \* \*

# **SECTION 33 41 00**

## **STORM UTILITY DRAINAGE PIPING**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

- A. The general provisions of the Contract, including General and Supplementary Conditions shall apply to the Work covered in this section.
- B. Related Work Specified Elsewhere:
  - 1. Trenching, Backfilling and Compacting - Section 31 23 33
  - 2. Standard Detail – 33 41 00-01

#### **1.02 DESCRIPTION OF WORK**

- A. The work covered under these specifications shall include the furnishing of all labor, material, tools, and equipment necessary to furnish and install, complete in place, all storm water drainage piping and related appurtenances as shown on the drawings and as specified herein.

#### **1.03 SUBMITTALS**

- A. The Contractor shall submit for review copies of shop drawings for materials specified herein.
- B. Certificates from the manufacturer that the materials meet or exceed specified requirements.
- C. The manufacturer's installation recommendations, including types and amounts of gasket lubricant, where applicable, to be used.

#### **1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. All materials shall be packed, loaded, transported, unloaded and handled in such a manner so as to prevent damage to the materials.
- B. All material shall be loaded, unloaded and placed in position by lifting with slings or hoists or skidding so as to avoid shock or damage. Dropping or rolling will not be permitted. The use of end hooks to install or move piping will not be allowed.
- C. All materials shall be stored on the site in accordance with the manufacturer's recommendations.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Reinforced concrete pipe shall conform to the requirements of Section 990 of the South Dakota Department of Transportation's 2015 Edition of Standard Specifications for Roads and Bridges or newest revision thereof. All reinforced concrete pipes shall be Class 2 unless otherwise stated in the plans.

- B. Polyethylene (PE) piping shall conform to the requirements set forth in Part 2.02 and 2.03.
- C. PVC storm sewer piping shall conform to the requirements set forth in Part 2.04.

#### 2.02 PE STORM SEWER PIPE

- A. Storm sewer pipe will conform to the requirements of ASTM D1248 Standard Specification for Polyethylene (P/E) Plastics Molding and Extrusion Materials and AASHTO M294 Type S.
- B. Pipe will be dual-walled with a smooth interior and corrugated exterior.
- C. All joints will be gasket style to provide a watertight connection capable of holding a 2.0-psi internal pressure for a minimum of 10 minutes.
- D. Fittings for PE pipe will have gasket style joints, be from the same manufacturer as the PVC pipe, and conform to the requirements of ASTM D3350.
- E. Tapping saddle tees/Inserta Tees may be used for lateral connections.

#### 2.03 PVC STORM DRAINAGE PIPING - SDR 35

- A. Polyvinyl Chloride (PVC) gravity pipe shall be Type I, Grade I, conforming to the requirements of ASTM Specification D 3034 for Rigid Poly (Vinyl Chloride) Sewer pipe.
- B. Solvent Cement for PVC pipe joints will not be allowed.
- C. Gasket type joints shall be made with rubber gaskets conforming to the requirements of ASTM F-477.

### **PART 3 EXECUTION**

#### 3.01 GENERAL

- A. Storm drainage piping shall be laid with the groove or bell end of the pipe upstream and the tongue end shall be inserted into the groove.
- B. Rubber gaskets at joints shall be installed according to the manufacturer's instructions.
- C. Proper equipment shall be provided by the Contractor for lowering the sections of pipe into place. Dropping the pipe into place will not be permitted.

#### 3.02 EXCAVATION

- A. Trenches shall be excavated to a width sufficient to allow for proper jointing of the pipe and thorough compaction of the bedding and backfill material under and around the pipe. Where feasible, trench walls shall be vertical. The completed trench bottom shall be firm for its full length and width.
- B. The foundation for each type of bedding shall be adequate to furnish a uniform stable support.

#### 3.03 BEDDING

- A. Bedding shall be used with all storm piping.

- 1. Class B bedding material (as seen in the Standard Drawing 33 41 00 – 1), will be used with all storm drainage piping and the bedding shall meet the follow**

**requirement:**

- a) Bedding material shall consist of pit run gravel with a minimum amount of rock retained on the 1" sieve and no more than 15% passing the #200 sieve. The gravel for bedding shall be approved by the Engineer prior to its use.

**3.04 DISPOSAL OF EXCESS MATERIAL**

- A. Any excess material, or material determined as unsuitable for backfill, shall be wasted at an area designated by the Engineer.

**3.05 TESTING OF GRAVITY STORM SEWERS**

**A. TEST SECTIONS**

1. The alignment tests of all gravity sewer lines shall be carried out on sections of sewer line located between manholes and/or inlets.
2. The Contractor shall be solely responsible for any and all damage to the pipeline, and to public and private property, which may result from defective material or workmanship.
3. Concrete and corrugated metal pipe will not be tested for infiltration or exfiltration, unless specifically called out in the plans.

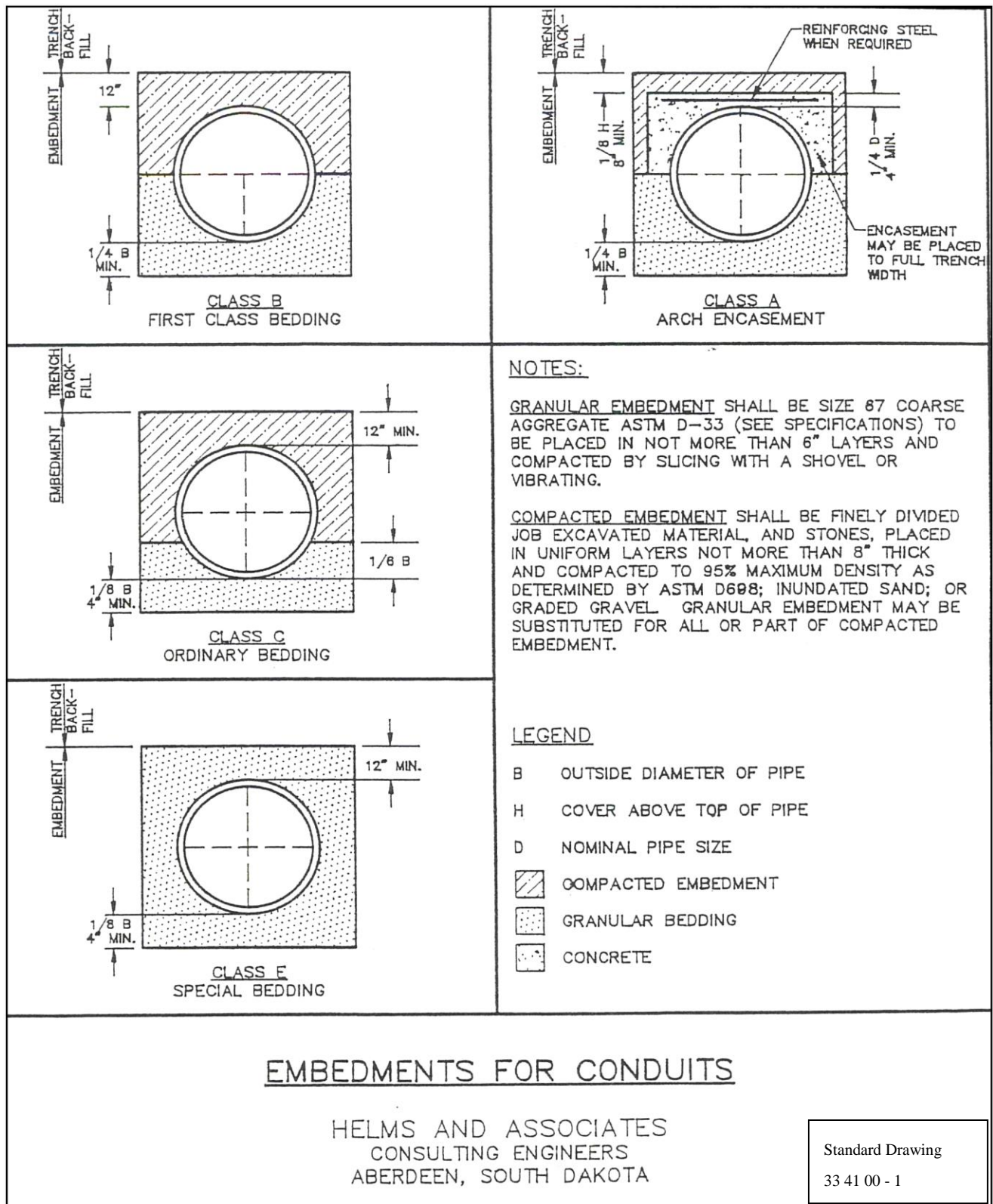
**B. GRAVITY SEWER LINE DISPLACEMENT AND DEFLECTION**

1. All tests for alignment and displacement of the gravity sewer lines will be made after the pipe has been laid and the trench backfilled and compacted as specified.
2. The Engineer's test procedure will be as follows: A light will be shined between manholes and/or inlets by means of a flashlight or by reflecting sunlight with mirrors.
3. The Engineer may require the Contractor to conduct random deflection tests between successive inlet in areas where unstable trench walls or bottoms, heavy rainfall, frozen soil, high ground water levels, deep lines or difficulty in achieving compaction is experienced.

**3.06 CLEANING OF GRAVITY SEWER LINES**

- A. All lines shall be thoroughly flushed and cleaned before acceptance until all traces of construction materials, soil or other foreign matter have been removed.
- B. The Contractor shall take all necessary measures to protect adjacent facilities and property. Damages caused by flushing water or water carried material shall be the responsibility of the Contractor.
- C. All flushing and cleaning shall be completed prior to the initiation of the testing process described in 3.05.





\*\*\* END OF SECTION \*\*\*