# Holiday Inn Express and Suites

**Southaven, MS**
***14-081***

# Contract Documents

**February 27, 2015**

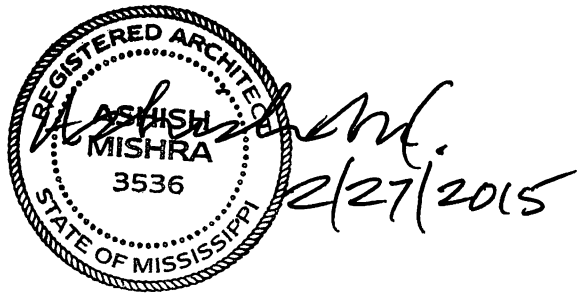


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**TABLE OF CONTENTS**


| Sect. No. | SECTION TITLE |
|---|---|
| **DIVISION 00** | |
| 000700 | GENERAL CONDITIONS |
| 000800 | SUPPLEMENTARY CONDITIONS |
| **DIVISION 01 – GENERAL REQUIREMENTS** | |
| 011000 | SUMMARY |
| 012900 | PAYMENT PROCEDURES |
| 013100 | PROJECT MANAGEMENT AND COORDINATION |
| 013300 | SUBMITTAL PROCEDURES |
| 014000 | QUALITY REQUIREMENTS |
| 014533 | STRUCTURAL TESTING AND SPECIAL INSPECTION |
| | Structural Testing and Special Inspection Program Summary Schedule |
| 015713 | EROSION AND SEDIMENT CONTROLS |
| 015000 | TEMPORARY FACILITIES AND CONTROLS |
| 016000 | PRODUCT REQUIREMENTS |
| 017419 | CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL |
| 017700 | CLOSEOUT PROCEDURES |
| **DIVISION 02 – EXISTING CONDITIONS** | |
| 024113 | SELECTIVE SITE DEMOLITION |
| **DIVISION 03 – CONCRETE** | |
| 031000 | CONCRETE FORMING AND ACCESSORIES |
| 031510 | POST-INSTALLED ANCHORS |
| 032000 | CONCRETE REINFORCING |
| 033000 | CAST-IN-PLACE CONCRETE |
| 035300 | CONCRETE TOPPING |
| 035400 | GYPSUM CEMENT UNDERLAYMENT |
| **DIVISION 04 – MASONRY** | |
| 047300 | SIMULATED MANUFACTURED STONE |
| **DIVISION 05 – METALS** | |
| 051200 | STRUCTURAL STEEL FRAMING |
| 053100 | STEEL DECKING |
| 055000 | METAL FABRICATIONS |
| 055213 | PIPE AND TUBE RAILINGS |
| **DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES** | |
| 061000 | ROUGH CARPENTRY |
| 061600 | SHEATHING |
| 061753 | SHOP-FABRICATED WOOD TRUSSES |
| 062023 | INTERIOR FINISH CARPENTRY |
| 064023 | INTERIOR ARCHITECTURAL WOODWORK |

066400 PLASTIC PANELING

**DIVISION 07 – THERMAL AND MOISTURE PROTECTION**
071113 BITUMINOUS DAMPPROOFING
071900 WATER REPELLENTS
072100 THERMAL INSULATION
072400 EIFS (EXTERIOR INSULATION AND FINISH SYSTEMS)
072500 WEATHER BARRIERS
072726 FLUID-APPLIED MEMBRANE AIR BARRIERS
075423 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING
076200 SHEET METAL FLASHING AND TRIM
077200 ROOF ACCESSORIES
078413 PENETRATION FIRESTOPPING
078446 FIRE-RESISTIVE JOINT SYSTEMS
079200 JOINT SEALANTS

**DIVISION 08 – OPENINGS**
081113 HOLLOW METAL DOORS AND FRAMES
081416 FLUSH WOOD DOORS
083113 ACCESS DOORS AND FRAMES
083614 TILT-UP DOORS
084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
084229 AUTOMATIC ENTRANCES
087100 DOOR HARDWARE
088000 GLAZING
088300 MIRRORS
089000 LOUVERS AND VENTS

**DIVISION 09 – FINISHES**
092116.23 GYPSUM BOARD SHAFT WALL ASSEMBLIES
092900 GYPSUM BOARD
093000 TILING
095123 ACOUSTICAL TILE CEILINGS
096400 WOOD FLOORING
096513 RESILIENT BASE AND ACCESSORIES
096516 RESILIENT SHEET FLOORING
096519 RESILIENT TILE FLOORING
096813 TILE CARPETING
096816 SHEET CARPETING
097200 WALL COVERINGS
099113 EXTERIOR PAINTING
099123 INTERIOR PAINTING

**DIVISION 10 – SPECIALTIES**
101400 SIGNAGE
101453 TRAFFIC SIGNAGE
102600 WALL AND DOOR PROTECTION

102800 TOILET ACCESSORIES
104413 FIRE EXTINGUISHER CABINETS
104416 FIRE EXTINGUISHERS

**DIVISION 12 – FURNISHINGS**

**DIVISION 13 - SWIMMING POOLS**
131110 POOL GENERAL PROVISIONS
131140 POOL PIPE, FITTINGS & VALVES
131141 POOL STRUCTURE
131144 POOL CHEMICAL EQUIPMENT
131146 POOL FEATURES AND EQUIPMENT
131147 POOL SIGNAGE

**DIVISION 14 – CONVEYING EQUIPMENT**
142400 HYDRAULIC ELEVATORS

**DIVISIONS 21 - FIRE SUPPRESSION**
210500 FIRE PROTECTION BASIC MATERIALS AND METHODS
211000 WATER BASED FIRE PROTECTION SYSTEMS

**DIVISION 22 - PLUMBING**
220513 ELECTRIC MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT
220519 METERS AND GAUGES FOR PLUMBING PIPING
220523 GENERAL DUTY VALVES FOR PLUMBING PIPING
220529 HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
220553 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT
220716 PLUMBING EQUIPMENT INSULATION
220719 PLUMBING PIPING INSULATION
220993 PLUMBING SEQUENCE OF OPERATION
221005 PLUMBING PIPING
221006 PLUMBING PIPING SPECIALTIES
221123 NATURAL GAS PIPING
223000 PLUMBING EQUIPMENT
224000 PLUMBING FIXTURES

**DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING**
230513 ELECTRICAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT
230519 METERS AND GAUGES FOR HVAC
230529 HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
230548 VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT
230553 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT
230593 ADJUSTING, AND BALANCING FOR HVAC
230713 DUCT INSULATION

**DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING (CONT.)**
230719 HVAC PIPING INSULATION

230913 INSTRUMENTATION AND CONTROL DEVICES FOR HVAC
230993 HVAC SEQUENCE OF OPERATIONS
232300 REFRIGERANT PIPING AND SPLIT SYSTEM EQUIPMENT
233100 HVAC DUCTS AND CASINGS
233300 AIR DUCT ACCESSORIES
233413 HVAC FANS
233700 AIR OUTLETS AND INLETS
234000 HVAC AIR CLEANING DEVICES
236200 PACKAGED AIR COOLED REFRIGERATION SYSTEMS COMPRESSOR AND CONDENSING UNIT
238219 PACKAGED TERMINAL AIR CONDITIONING UNITS

**DIVISIONS 26- ELECTRICAL**
260500 GENERAL REQUIREMENTS
260519 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)
260526 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260533 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS
260926 LIGHTING CONTROL SYSTEM
262413 SWITCHBOARDS
262416 PANELBOARDS
262726 WIRING DEVICES
262774 ELECTRIC HEATERS
262812 ENCLOSED SWITCHES AND CIRCUIT BREAKERS
262813 FUSES
262913 ENCLOSED CONTROLLERS
264300 SURGE PROTECTIVE DEVICE (SPD)
265100 LIGHTING

**DIVISION 27 - COMMUNICATIONS**
271005 HORIZONTAL STRUCTURED CABLING SYSTEM FOR VOICE AND DATA
275133 CABLE TELEVISION SYSTEM

**DIVISION 28 - ELECTRONIC SAFETY AND SECURITY**
282330 VIDEO SURVEILLANCE SYSTEM
283101 FIRE DETECTION AND ALARM

**DIVISION 31 - EARTHWORK**
310000 EARTHWORK
311000 SITE CLEARING
312000 EARTH MOVING

312333 TRENCHING AND BACKFILLING
313700 RIPRAP AND SLOPE PAVING
315713 EROSION AND SEDIMENT CONTROLS

**DIVISION 32 – EXTERIOR IMPROVEMENTS**
321000 CONCRETE CURBS AND WALKS
321122 AGGREGATE BASES
321216 ASPHALT CONCRETE PAVING
321313 EXTERIOR CONCRETE PAVING
321373 CONCRETE PAVING JOINT SEALANT
329223 SOLID SODDING

**DIVISION 33 - UTILITIES**
331000 WATER DISTRIBUTION
333000 SANITARY SWERAGE UTILITIES
334000 STORM DRAINAGE

Attachments :
EXG Finishes Specifications.
EXP Finishes Specifications.
Special Inspections form
Geotechnical Report
Mishra Architecture Forms

| | |
|---|---|
| ***PROJECT:*** | **Holiday Inn Express (HIX) Prototype Design** |
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**END OF PROJECT RECORD**

SECTION 00700 - GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specifications apply to this section.

1.02 AIA DOCUMENT A201 – 2007 EDITION

A. The latest edition of AIA Document A201, General Conditions of the Contract for Construction, is herein included as part of the Contract by reference.

1. Copies of AIA Document No. A201, General Conditions of the Contract for Construction, are available at the Architect's office or the local Chapter of The American Institute of Architects.
2. The Contractor shall obtain and use only an original copy of the AIA Document No. A201, General Conditions of the Contract for Construction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00700

SECTION 00800 - SUPPLEMENTARY CONDITIONS

PART 1 – GENERAL

1.01 SUPPLEMENTAL CONDITIONS

A. The following supplements modify, change, delete from, or add to the "General Conditions of the Contract for Construction". AIA Document A201, Sixteenth Edition, 2007. Where any Article of the General Conditions is modified by any Paragraph, Subparagraph or clause hereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of that Article. Paragraph Subparagraph, or Clause shall remain in effect.

ARTICLE 1

GENERAL PROVISIONS
1.1 BASIC DEFINITION

1.1.6 THE SPECIFICATIONS

1.1.6.1 The Specifications shall include exhibits that pertain to the Work as specified by the Owner included in this Project Manual and as noted in the Table of Contents.

ARTICLE 2

CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS

Add the following Subparagraphs 3.2.5, 3.2.6, 3.2.7:

3.2.4 On all drawings, figures take precedence over measurements by scale. Any scaling is done at the Contractor's own risk. The Architect will decide on questions that may arise regarding the meaning and intent of Drawing and Specifications. In the event the Contractor proceeds with the Work without requesting clarification of meaning or intent, the Contractor shall be responsible for the correction of the Work and will do so at his own expense.

3.2.5 Before ordering any material or doing any of the Work, the Contractor shall verify all measurements and shall be responsible for the correctness of same. Report any noticeable discrepancy to the Architect immediately for his consideration and decision. Check all parts of the Work and lay out in order that the contraction as a whole conforms to intent of Drawings.

3.2.6 Failure to examine the Project site and the Contract Documents, and to become familiar with existing conditions shall not constitute cause for compliant or claim for extra payment. Accept the Project Site as it exists. The site will be available to the Contractor upon receipt

of the Architect's written Notice to Proceed. Care, Custody and control of the site or premises is vested in the Contractor during the term of Operations under the Contract, subject to rights of the Owner.

ARTICLE 9

PAYMENTS AND COMPLETION

9.3 APPLICATION FOR PAYMENT

Delete Subparagraph 9.3.1 in its entirety and substitute the following:

9.3.1 Applications for Payment shall be prepared only on AIA Document G702 "Application and Certificate for Payment" and AIA Documents G702A "Continuation Sheet". These forms will be available, upon request, from the Architect.

Until 50% Completion, the Owner will pay ninety percent (90%) of the amount due to the Contractor on account of progress payments, after which remaining partial payments shall be paid in full without reduction of the previous retainage. Payment will also be made in the amount of 75% for materials properly stored on site.

The Contractor shall be required to submit, with each payment request after the first payment, lien waivers covering the total amount previously paid. Lien waivers from Suppliers and Subcontractors shall clearly indicate exact dollar amounts as payment in full or shall contain a statement indicating a waiver of lien for all materials and/or labor furnished up to date of the lien waiver. The Contractor shall cover the difference for a given section with his own lien waiver to reflect his participation in the overall payment. The Contractor shall also submit a lien waiver on his behalf for the entire amount of the Draw Request.

9.3.2 Applications for Payment shall be made directly to the Owner’s Representative, by the 5th of the month for the previous month's work. Applications for Payment shall be reviewed by the Owner and the Architect in triplicate on or before the 15th of each month and payment made by the 20th. Any incomplete application or improper back-up will delay the payment process until the following month's application.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 00800

# SECTION 011000 - SUMMARY

## PART 1 - GENERAL

### 1.1 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Holiday Inn Express and Suites.

B. Project Location: Southaven, MS

C. The Work consists of the following:

1. The Work includes construction of a free standing four-story Holiday Inn Express as designed, detailed, and specified in contract documents.

D. Project will be constructed under a single prime contract.

### 1.2 USE OF PREMISES

A. General: Contractor shall have full use of the space within construction limits for construction operations, and coordinate the use of project site with owner.

### 1.3 OWNER'S OCCUPANCY REQUIREMENTS

A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

END OF SECTION 011000

# SECTION 012900 - PAYMENT PROCEDURES

## PART 1 - GENERAL

### 1.1 SUMMARY

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

### 1.2 SCHEDULE OF VALUES

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

1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Application for Payment forms with Continuation Sheets, Submittals Schedule and Contractor's Construction Schedule.
2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

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

1. Submit draft of AIA Document G703 Continuation Sheets.

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

### 1.3 APPLICATIONS FOR PAYMENT

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

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

C. Payment Application Times: Progress payments shall be submitted to Architect by the 5$^{th}$ of the month. The period covered by each Application for Payment is one month, ending on the last day of the month

D. Retainage: Until substantial completion, retainage from progress payments to the contractor shall be 10% of each payment until work is 50% complete, after which remaining partial payment shall be paid in full without reduction of the previous retainage. Payments will also be made in the amount of 75% for materials property stored on site.

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

F. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit final or full waivers.

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

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
3. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
4. Evidence that claims have been settled.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

# SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

### 1.1 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.
4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

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

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

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

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

1.2 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:

1.3 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Review present and future needs of each entity present, including the following:
   a. Status of work
   b. Sequence of Operations
   c. Status of Submittals
   d. Long Lead Items.
   e. Contractors Construction Schedule.
   f. RFI’s.
   g. Status of Proposed Requests.
   h. Status of Change Orders.
   i. Documentation of information for payment requests.
4. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including owner and architect, within three days of the meeting.
5. Architect will attend construction meetings based on contract with owner.

1.4 REQUESTS FOR INTERPRETATION (RFI’s)

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

1. RFI’s shall originate with Contractor. RFI’s submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFI’s in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

C. RFI Log: Prepare, maintain, and submit a tabular log of RFI's organized by the RFI number.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

# SECTION 013300 - SUBMITTAL PROCEDURES

## PART 1 - GENERAL

### 1.1 SUBMITTAL PROCEDURES

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit three copies of each submittal.

B. Submittals Schedule: Submit to architect complete schedule of submittals anticipated.

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

1. Initial Review: Allow 7 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 7 days for review of each resubmittal.

D. Identification: Place a permanent label or title block on each submittal for identification.

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

F. Use for Construction: Use only final submittals with mark indicating "reviewed, approved or furnish as corrected" taken by Architect.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

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

END OF SECTION 013300

# SECTION 014000 - QUALITY REQUIREMENTS

## PART 1 - GENERAL

### 1.1 QUALITY CONTROL

A. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
2. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

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

### 1.2 SPECIAL TESTS AND INSPECTIONS

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

1. General contactor to provide allowance in the contract sum for cost of testing that is the responsibility of the owner.
1. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows: Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

END OF SECTION 014000

# SECTION 01 4533 - STRUCTURAL TESTING AND SPECIAL INSPECTION

## PART 1 GENERAL

### 1.1 INTENT AND CONDITIONS

A. Intent

1. Define and coordinate structural testing and special inspection services.

2. Provide a greater level of confidence that the specified work is constructed in compliance with the contract documents and the intent of applicable codes including Section 1704 of the 2012 International Building Code (IBC) as adopted by the Sate in which the Project is located.

3. Structural testing and special inspection services are intended to assist in determining probable compliance of the work with requirements specified. These services do not relieve the Contractor of responsibility for compliance with the requirements of the contract documents.

B. Conditions

1. If inspection of a fabricator's work is required, the Owner's representative may require testing and inspection of the work at the plant, before shipment. Owner and Architect reserve the right to reject material not complying with the Contract Documents.

2. Refer to individual technical specification sections for specific qualifications, inspections, tests, frequency and standards required. Testing and inspection shall be performed in accordance with the referenced standard for the specific material or procedure unless other criteria are specified. In the absence of a referenced standard, tests shall be performed in accordance with generally accepted industry standards.

3. Work shall be checked as it progresses. Failure to detect any defective work or materials shall not prevent later rejection if defective work or materials are discovered, nor shall it obligate Owner to accept such work.

4. Structural testing, special inspection, and periodic inspections by the Building Official do not preclude the normal field involvement and site observations by Architect or SER.

5. Structural testing, special inspection, and periodic inspections by the Building Official do not relieve the Contractor of any responsibility to complete the work in accordance with the approved drawings and specifications.

6. Testing agents and/or special inspectors may not waive or alter contract requirements, or approve or accept any portion of the work unless specifically authorized by the Architect

or SER. They may not assume any duties of the Contractor, and they have no authority to stop or reject work.

1.2 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications apply to this section.

1.3 DEFINITIONS

A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.

B. Inspection: Evaluation of systems, primarily requiring observation and judgment.

C. Structural Special Inspections: Structural special inspections include inspections of structural items required by the 2012 IBC Section 1704, and other items, which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure and are indicated to be performed under the requirements of this section. They do not include special inspections for non-structural items such as fireproofing, EIFS, and smoke control systems.

D. Structural Testing: Structural testing includes those tests of structural items required by the 2012 IBC, or its referenced standards, and other tests, which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure and are indicated to be performed under the requirements of this section.

E. Architect of Record: The prime consultant in charge of overall design and coordination of the project.

F. Structural Engineer of Record (SER): The licensed professional engineer in responsible charge of the structural design for the project.

G. Licensed Structural Engineer: A professional engineer with education and experience in the design of structures similar to this project licensed to practice in the State in which the Project is located.

H. Testing Agency (TA): The properly qualified firm performing testing services.

I. Special Inspector (SI): A properly qualified individual or firm performing special inspections.

J. Building Official: The officer or his duly authorized representative charged with the administration and enforcement of the building code for the project.

1.4 REFERENCES

A. ASTM C1077-02 – Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

B. ASTM C1093-95 - Practice for the Accreditation of Testing Agencies for Unit Masonry.

C. ASTM D3740-01 - Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

D. ASTM E329-02 - Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

E. ASTM E543-02 - Practice for Agencies Performing Nondestructive Testing.

F. International Building Code (IBC), 2012.

1.5 QUALIFICATIONS

A. Testing Agency: An approved independent testing agency acceptable to the Owner, Architect, and SER and meeting the following:

1. Authorized to operate in the State in which the project is located and experienced with the requirements and testing methods specified in the Contract Documents.

2. Meet applicable requirements of references stated in paragraph 1.4.

3. Have available testing equipment that is calibrated, at reasonable intervals, by devices of accuracy traceable to either the National Bureau of Standards, or to accepted values of natural physical constants.

4. Provide individuals performing tests and taking samples with appropriate certifications for work performed.

B. Special Inspector: Either an appropriately certified inspector or a civil/structural engineer performing under the direct supervision of a licensed structural engineer (as defined earlier in this section) and acceptable to the SER and Building Official. Unique special inspector requirements, for specific materials and systems, are noted in related technical specification sections.

1.6 RESPONSIBILITIES

A. Special Inspectors:

1. Inspect the work assigned for conformance with the building department approved plans, specifications, and applicable material and workmanship provisions of the code. Perform inspection in a timely manner to avoid delay of work.

2. Bring nonconforming items to the immediate attention of the contractor for correction. If not corrected within 24 hours or if inspector will not be on site the following day, bring to the attention of the SER by the end of the business day. If uncorrected after a reasonable period of time, bring to the attention of the Building Official, and to the Architect. Notify SER immediately if non-conforming items are enclosed, embedded, or obscured prior to verification of correction.

3. Submit inspection reports to the Building Official, Contractor, the Architect, the SER, and other designated persons in accordance with the structural testing and special inspection schedule.

4. Submit a final signed report stating whether the work requiring special inspection was, to the best of his/her knowledge, in conformance with the approved plans, specifications and the applicable workmanship provisions of the code.

5. Sign the structural testing and special inspection schedule in conjunction with other responsible parties.

6. Attend preconstruction meeting to review scope of special inspection.

B. Testing Agency:

1. Test the work assigned for conformance with the building department approved plans, specifications, and applicable material provisions of the documents. Perform tests in a timely manner to avoid delay of work.

2. Submit test reports to the Building Official, Contractor, the Architect, the SER, and other designated persons in accordance with the structural testing and special inspection schedule.

3. Sign the structural testing and special inspection schedule in conjunction with other responsible parties.

4. Attend a preconstruction meeting to review scope of structural testing.

C. Contractor:

1. Attend a preconstruction meeting to review scope of structural testing and special inspection.

2. Post or make available the structural testing and special inspection schedule within its office at the job site. Also, provide adequate notification to those parties designated on the schedule so they may properly prepare for and schedule their work.

3. Provide special inspectors access to the approved plans and specifications at the job site.

4. Review all reports issued by special inspectors.

5. Retain, at the job site, all reports submitted by the special inspectors for review on the Building Official's request.

6. Correct deficiencies identified in inspection or testing reports in a timely manner.

7. Provide safe access to the work requiring inspection or testing.

8. Provide labor and facilities to provide access to the work, to obtain, handle and deliver samples, to facilitate testing and inspection and for storage and curing of test samples.

9. Verify conformance of the work with specified construction tolerances.

10. Inspections by Building Official: Provide adequate notice for inspections performed by the building official, as required by IBC Section 110, the State Building Code, and local ordinances.

11. Sign the structural testing and special inspection schedule in conjunction with other responsible parties prior to commencing construction.

D. Fabricator:

1. Submit a Certificate of Compliance to the Building Official, Special Inspector, and SER that the work was performed in accordance with the approved plans and specifications.

2. Sign the structural testing and special inspection schedule in conjunction with other responsible parties prior to commencing construction.

E. Owner:

1. Establish direct funding to provide for cost of structural testing and special inspection services.

2. Provide special inspector with approved plans, specifications and approved shop drawings.

3. Provide special inspectors and testing agencies with full access to the site at all times.

4. Sign the Structural testing and special inspection schedule in conjunction with other responsible parties.

## 1.7 PAYMENT

A. Owner or Architect/SER, acting as the Owner's agent, will employ and pay for services of the special inspectors and testing agency to perform required structural testing and special inspection.

B. Unless noted otherwise, the Contractor shall provide and pay for all materials, samples, mock-ups, and assemblies required for testing and inspection and shall pay for shipping costs related to delivery of such items. Testing agency will pay for shipping costs of samples transported from site to lab.

C. If items requiring testing or inspection are enclosed, embedded or obscured prior to testing or inspection or if such items are placed without tests or inspections, the Contractor shall pay for the costs of any exploratory work deemed necessary by the Architect/SER to verify compliance with the Contract Documents.

D. Contractor shall pay for the costs of any retests or re-inspections caused by work that does not comply with the Contract Documents based on initial tests or inspections, or work that is later revised or replaced by the Contractor. This does not include revisions requested by the Owner.

## 1.8 INSPECTION NOTICE

A. Provide minimum of 24 hours notice for all items requiring testing or inspection. Items requiring testing and inspection services prior to or during placement shall not be placed until testing and inspection services are available. Items requiring testing and inspection services after placement shall not be enclosed or obscured until testing and inspection services are performed.

## 1.9 REPORTS

A. Testing agency and special inspectors shall submit reports for structural testing and special inspection in a timely manner to the Contractor, Building Official, SER, and Architect of Record. Provide reports of daily activities to the SER and Contractor. Submit reports to the Contractor on a daily basis and to the SER on a daily or weekly basis. Provide summary reports to the Building Official and Architect on a monthly basis unless they request otherwise.

B. Provide reports for ongoing work, containing the following information:

1. Date issued.

2. Project title and number.

3. Firm name and address.

4. Name and signature of tester or inspector.

5. Date and time of sampling, test, or inspection.

6. Identification of product and specification section.

7. Location in project, including elevations, grid location and detail.

8. Type of test or inspection.

9. Whether test specimens, test results or observations indicate compliance with Contract Documents. Specifically state any discrepancies

10. Types and locations of discrepancies found in work

11. Work required performed to correct discrepancies and work performed to correct previously noted discrepancies. Discrepancies corrected during an inspection need not be reported

12. Submit certified final special inspection report stating that, to the best of the special inspector's knowledge, the work requiring special inspection conformed to the Construction Documents.

## 1.10 FREQUENCY OF TESTING AND INSPECTION

A. For detailed requirements, see individual technical specification sections and the structural testing and special inspection schedule.

## 1.11 PROTECTION AND REPAIR

A. Upon completion of testing, sample-taking, or inspection, the Contractor shall repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed surfaces, as judged solely by the Architect/SER. Protect work exposed by or for testing and/or inspection and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for testing and/or inspection.

## 1.12 TESTS TO DEMONSTRATE QUALIFICATION

A. Any tests required to qualify the Contractor or the workers for any phase of the work, shall be performed at no additional cost to the Owner.

B. If the Contractor proposes a product material, method, or other system that has not been pre-qualified, the Architect/SER may require applicable tests to establish a basis for acceptance or rejection. The Contractor shall pay for these tests.

C. The Architect/Engineer of Record reserves the right to require certification or other proof that the system proposed is in compliance with specified tests, criteria or standards. A representative of an independent testing agency shall sign the certificate.

## 1.13 STRUCTURAL TESTING AND SPECIAL INSPECTION SCHEDULE

A. The parties involved shall complete and sign the structural testing and special inspection schedule. Schedule to be complete at time of permit issuance.

B. The completed schedule is an element of the construction documents and after permit issuance, becomes part of the building department approved plans and specifications

END OF SECTION

# SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

## PART 1 - GENERAL

### 1.1 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

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

### 1.2 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

### 3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or use and connect to existing service when authorized by landlord.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

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

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

E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

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

G. Telephone Service: Provide temporary telephone service or cell phone access in common-use facilities for use by all construction personnel.

## 3.3 SUPPORT FACILITIES INSTALLATION

A. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.

## 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

D. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 015000

# SECTION 01 5713 - EROSION AND SEDIMENT CONTROLS

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Provide protection of the environment during the construction of this project to reduce soil erosion and siltation to meet all local, state and federal standards.

C. Erosion and sediment control including, but not limited to;

1. Construction of permanent erosion checks and controls
2. Silt Fence
3. Erosion Control Blankets
4. Turf Reinforcement Material
5. Inlet Sediment Prevention Devices
6. Temporary and Permanent Seed
7. Rip Rap
8. Rock Construction Entrance
9. Straw Mulch
10. Straw Logs (Bio Logs)
11. Temporary Sediment Traps
12. Earthen Berms
13. Water Course Protection
14. Diversion Ditches and Slopes
15. Rain Gardens

D. Prevention of erosion due to construction activities.

E. Prevention of sedimentation of waterways, open drainage ways, and storm sewers due to construction activities.

F. Restoration of areas eroded due to insufficient preventive measures.

G. Maintain, replace and remove all erosion control devices once vegetation has been established and all areas have been paved.

H. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 PERFORMANCE REQUIREMENTS

A. Comply with all governing agency requirements for erosion and sedimentation control.

B. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

C. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

D. Erosion On-site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.

1. Control movement of sediment and soil from temporary stockpiles of soil.

2. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

E. Erosion Off-site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.

1. Prevent windblown soil from leaving the project site.

2. Prevent tracking of mud onto public roads outside site.

3. Prevent mud and sediment from flowing onto sidewalks and pavements.

4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

F. Sedimentation of Waterways On-site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways and sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

G. Sedimentation of Waterways Off-site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways and storm sewers.

1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

H. Open Water: Prevent standing water that could become stagnant.

I. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

## 1.3 GENERAL

A. Exercise every precaution, throughout the life of the project, to prevent the eroding of soil and the silting of rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces, or other property. Erosion control practices to be used for this project are as indicated on the Drawings and directed by the local governing agency.

B. The Contractor is solely responsible for the cleanup of any rivers, streams, lakes, reservoirs, other water impoundments, ground or roadway surfaces or other property damaged by construction activity related to this project.

C. Coordinate the placement of temporary turf establishment provisions with the placement of permanent turf establishment.

## 1.4 QUALITY CONTROL

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor shall assign one of their field personnel as the designated erosion control inspector. The inspector shall be knowledgeable and experienced in the application of erosion prevention and sediment control Best Management Practices (BMPs). The inspector shall review the effectiveness of the installed erosion and sediment control devices once every seven days and after each rainstorm event. It shall be the Contractor's responsibility to repair breaches and replace deteriorated or missing items.

E. The Architect will make site visits to observe the placement and condition of all temporary and permanent erosion control devices.

## 1.5 REGULATORY AGENCIES

A. Comply with requirements of state, regional, and local erosion and sediment control authorities.

## 1.6 SUBMITTALS

A. Product Data: Submit manufacturer's product data for silt fence materials; including fabrics and posts.

# PART 2 EXECUTION

## 2.1 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

## 2.2 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

## 2.3 GENERAL

A. Construct and maintain all erosion control measures until the Substantial Completion of the project, or as directed by the Architect.

B. Install temporary erosion and sediment control items prior to site preparation.

C. The Contractor shall schedule and conduct their operations to minimize the erosion of soils, to prevent siltation, and to minimize the turbidity of storm sewer runoff entering storm sewers, streams, ditches and lakes.

D. No work shall be started in the affected area until the applicable erosion control schedules and methods have been accepted by the designated erosion control inspector.

E. The Contractor shall install adequate safeguards to minimize water pollution from haul roads, work platforms, temporary earthen fills and any other temporary construction that he uses to facilitate construction. The Contractor shall obtain all necessary permits form the regulatory agencies for temporary work not shown on the Drawings.

## 2.4 EROSION CONTROL

A. The Contractor shall install sediment traps at existing and proposed catch basins within the construction zone. Sediment traps shall remain in place until turf and pavement surfaces are established. Filter fabric between casting and frame will not be allowed. Contact Architect prior to removal.

B. Repair or replace any erosion control devices that have been disrupted during operations as required by local regulation.

C. Silt fence and sediment control devices are to be installed and shall to remain in place until turf has been established. Contact the Architect prior to removal.

D. The Contractor shall schedule and conduct their operations so as to minimize erosion of soils and to prevent silting and muddying of streams, irrigation systems and impoundments (lakes, reservoirs, etc.). Construction of drainage facilities, turf establishment items and other Contract Work that will contribute to the control of erosion and sedimentation shall be carried out concurrently with earthwork operations or as soon thereafter as practicable.

E. Where erosion is likely to be a problem and where potentials for water pollution exist, the Contractor shall prepare and submit to the Architect for acceptance, their proposed schedules for accomplishment of the effected Work, including any temporary measures proposed. No work shall be started in the affected areas until the applicable erosion control schedules and the Architect has accepted the proposed methods of operation.

F. The Architect shall have authority to limit the surface area of erodible soil that can be exposed to possible erosion at any time, without having the permanent erosion control features completed and operative.

G. While operations are in progress and prior to suspension of grading operations for longer than fourteen (14) days, areas of bare soil exposed to erosion possibility shall be shaped to permit storm runoff with minimum erosion. Temporary berms, dikes, slope drains or sedimentation basins will be required where possibilities for water pollution exist and the permanent erosion controls are not completely operative.

H. Erosion control devices shall remain in place until other means of permanent control such as turf establishment and paving has taken place.

I. Restoration:

1. Control of drainage and erosion shall include restoration work as the Architect considers necessary in preventing siltation of public waters. Restoration shall include cleanup, shaping, and replacement of topsoil and establishment of vegetative cover on all disturbed areas where water pollution potentials have been increased due to the Contractor's operations.

J. Compensation:

1. All expenses incurred in complying with the provisions hereof and effectively preventing pollution of public waters shall be borne by the Contractor with no direct compensation being made therefore.

## 2.5 REMOVAL AND CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

# SECTION 016000 - PRODUCT REQUIREMENTS

## PART 1 - GENERAL

### 1.1 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

### 2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 15 days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

## PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

# SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

## PART 1 - GENERAL

### 1.1 SUMMARY

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

1. Recycling nonhazardous **construction** waste.
2. Disposing of nonhazardous **construction** waste.

B. Related Sections:

1. Division 04 Section "Simulated Manufactured Stone" for disposal requirements for excess stone and stone waste.
2. Division 31 Section "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

### 1.2 DEFINITIONS

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

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

### 1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of **50** percent by weight of total non-hazardous solid waste generated by the Work. Facilitate recycling and salvage of **materials.**

### 1.4 INFORMATIONAL SUBMITTALS

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

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

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

1.5 QUALITY ASSURANCE

A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RECYCLING **CONSTRUCTION** WASTE, GENERAL

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

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.

1. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
2. Store components off the ground and protect from the weather.
3. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.2 RECYCLING CONSTRUCTION WASTE

A. Packaging:

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

B. Site-Clearing Wastes: Chip brush, branches, and trees **at landfill facility**.

C. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

D. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

## 3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

## 3.4 SAMPLE FORMS

END OF SECTION 017419

# SECTION 017700 - CLOSEOUT PROCEDURES

## PART 1 - GENERAL

### 1.1 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, and similar final record information.
5. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
6. Complete final cleaning requirements, including touchup painting.
7. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

### 1.2 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.3 WARRANTIES

A. Provide copies of each warranty to include in operation and maintenance manuals.

B. Contractor to provide minimum one year contractor's warranty.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, [elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

r. Leave Project clean and ready for occupancy.

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

END OF SECTION 017700

# SECTION 02 4113 - SELECTIVE SITE DEMOLITION

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Selective site demolition of designated items; including removal of materials from site, legal disposal off-site and salvage of items which are identified on the plan documents for Owner.

B. Abandonment and removal of identified existing utilities and utility structures.

### 1.2 REFERENCES

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2004.

### 1.3 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. Demolition Firm: Company specializing in the type of work required.

### 1.4 SUBMITTALS

A. Schedule: Indicate demolition and removal sequence and location of salvageable items, location and construction of barricades, fences and temporary work.

B. Project Record Documents: Accurately record actual locations of capped and active utilities, subsurface construction and any other items relocated.

### 1.5 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding.

B. Protection of Persons: Install barricades, as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements.

F. The Contractor shall review proposed and finished grade elevations as well as the proposed pavement thicknesses.

## 1.6 REGULATORY REQUIREMENTS

A. Conform to State Building Code and all applicable codes for demolition of site structures, safety of adjacent structures, dust control, run-off control and disposal.

B. Notify affected utility companies before starting work and comply with their requirements, as outlined under the provisions of Division One Specifications.

C. Do not close or obstruct roadways, sidewalks or hydrants without permits.

D. Test soils around buried tanks for contamination.

E. Conform to applicable building codes for dust control and run-off control.

## PART 2 EXECUTION

### 2.1 PREPARATION

A. Provide, erect and maintain temporary barriers, traffic control and security devices at locations as directed by the Architect and Owner.

B. Protect existing landscape materials, appurtenances, and structures that are not to be demolished.

C. Prevent movement or settlement of adjacent structures. Provide bracing or shoring.

D. Mark location of utilities.

E. All erosion control measures are to be installed and approved by the governing agencies.

### 2.2 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.
   a. Cease operations immediately if adjacent structures appear to be in danger. Notify the Architect and do not resume operations until directed.

6. Do not close or obstruct roadways or sidewalks without permit.

7. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

9. Sprinkle work with water to minimize dust. Provide hoses and water connections for this purpose.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

E. 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.

F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

## 2.3 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without written notification to Owner and Owner approval to proceed.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without written notification to Owner and Owner approval to proceed.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

## 2.4 CLEARING AND REMOVAL

A. General: Remove structures and facilities indicated on the Drawings. Remove and dispose of all structures, except for that which is permitted to remain upon determination being made by the Architect that their existence does not interfere with, endanger or detract from the new construction in any way.

B. Removal Operations: Perform removal operations that may endanger new construction prior to construction of affected Work.

C. Compliance with Instructions, Ordinances and State Laws: Comply with all instructions and ordinances of the governing agencies.

D. Disposal of Materials and Debris: Dispose of debris resulting from the removal and demolition operations in accordance with specific regulations imposed by laws, ordinances, orders and decrees.

E. Removal of Existing Structures: Remove and dispose of all structures, except for those that are specified to be removed by others or which are permitted to remain upon determination being made by the Architect that their existence does not interfere with, endanger or detract from the new construction in any way. Catch basins and manholes designated for removal shall be removed entirely and the pipe leads closed per governing agency standards. Manholes designated to remain shall be clearly marked in the field and protected at all times.

F. Removal of Existing Pavements: Where a portion of an existing pavement is to be retained for use, that portion shall not be damaged during removal operations. In removing concrete and bituminous pavements, sidewalks and similar structures, where the cut will be exposed in the finished Work, the structure shall, unless the removal is made to an existing joint and unless determined otherwise by the Architect, be sawed along the removal lines with a concrete saw to a depth of not less than one-half (1/2) the thickness of the concrete or bituminous before breaking off the concrete or bituminous. In such cases, the use of wedges, driven into the saw cut to break off the portion to be removed, will not be permitted. Elsewhere, the structure shall be cut and chipped to true lines and vertical faces.

G. Removal of Trees, Stumps, Brush and Vegetation: The clearing operations shall consist of the cutting and removal of trees, shrubs, bushes, windfalls and other vegetation in the designated areas. Grubbing operations shall consist of removing and disposing of the stumps, roots and other remains in their entirety.

H. Disconnect, remove and/or cap designated utilities within demolition areas.

I. All materials removed under this section shall be removed from the site. The cost of legal disposal of the existing materials shall be included in the Bid Price, and no additional compensation will be allowed.

## 2.5 SPECIAL PRECAUTIONS

A. Dewatering:

1. Prevent surface water and subsurface (ground) water from flowing into excavations and from flooding the site and surrounding area.

2. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to stability of subgrades and foundations. Provide and maintain pump, well points, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3. Convey water removed from excavations and rainwater to legal collection or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside

excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

## 2.6 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, trash and unused materials from site.

B. Burning of debris is not permitted on the Owner's property.

C. Remove all waste materials and unsuitable or excess topsoil from the Owner's property.

D. The cost of disposal of waste materials is considered part of the Base Bid Contract.

E. Remove from site all materials not to be reused on site.

F. Leave site in clean condition, ready for subsequent work.

G. Clean up spillage and wind-blown debris from public and private lands.

H. Keep all public roadways free of mud, soil and debris to the satisfaction of regulatory agencies.

END OF SECTION

# SECTION 03 1000 - CONCRETE FORMING AND ACCESSORIES

## PART 1 GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings, Details of Construction, and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

### 1.2 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

### 1.3 RELATED REQUIREMENTS

A. Section 01 4533 - Structural Testing and Special Inspection

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete.

D. Section 05 1200 - Structural Steel: Placement of embedded steel anchors and plates in cast-in-place concrete.

### 1.4 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute; 2011.

D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.

## 1.5 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

## 1.6 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Submit product data for form release agents and dovetail anchor slots.

## 1.7 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

# PART 2 PRODUCTS

## 2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of columns, and walls.

D. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

## 2.2 WOOD FORM MATERIALS

A. Form Materials: At the discretion of the Contractor.

## 2.3 FORMWORK ACCESSORIES

A. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

B. Form Ties: Removable type, galvanized metal, adjustable length, free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.

C. Dovetail Anchor Slot: Galvanized steel, 22 gage (0.8 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork. Match to tie manufacturer.

D. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Establish a bench mark in an accessible location and use as a reference point for various construction levels. Maintain in an undisturbed condition until final completion.

B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

### 3.2 EARTH FORMS

A. Earth forms are not permitted.

### 3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Lay out all work and check general building lines and levels established. Coordinate layout and measurements and if discrepancies arise, report them to the Architect.

D. Keep wood forms wet as necessary to prevent shrinkage.

E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Obtain approval before framing openings in structural members that are not indicated on drawings.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

J. Protect work at all times against the elements and other hazards. Cover and secure work.

## 3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

## 3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Build in recessed anchor slots for masonry veneer into concrete walls, columns, piers, beams, and spandrels deeper than 14 inches and wider than 16 inches. Position recessed anchor slots vertically, spaced at 16" on center.

E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

## 3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

## 3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117.

B. Tolerances given in ACI 117 are not cumulative. Maximum tolerance for any formed surface, except footings, shall be one inch.

## 3.8 FIELD QUALITY CONTROL

A. Structural Special Inspection

1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 4533.

2. Formwork for slabs on grade and strip footings without transverse reinforcement does not require inspection. Additional exceptions may be noted on the structural drawings.

3. Personnel Qualifications: Special Inspector – Structural I: ICBO certified concrete inspector or a graduate civil/structural engineer, or other personnel acceptable to the Structural Engineer of Record (SER), with the experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection reports.

4. The Owner will provide the following inspections:
   a. Verify formwork for all concrete, except as noted above, will result in member size, location, and configuration as described on the contract documents, only as it affects the structural integrity of the concrete elements to be placed. Verify removal of shoring conforms to this section. Qualifications: Structural I.

## 3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Forms for sides of walls, columns, and footings shall remain in place for a minimum of 24 hours.

C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

D. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

# SECTION 03 1510 - POST-INSTALLED ANCHORS

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Drawings, Details of Construction, and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

### 1.2 SECTION INCLUDES

A. Requirements pertaining to post-installed anchors for materials and equipment. This section pertains to Divisions 3, 5, and 6 of these specifications that require post-installed anchors, unless specified otherwise.

### 1.3 RELATED REQUIREMENTS

A. Division 1 – General Requirements

B. Division 3 – Concrete

C. Division 5 – Metals

D. Division 6 - Wood, Plastics, and Composites

### 1.4 REFERENCES

A. ACI 355.2 – Standard for Evaluating the Performance of Post-Installed Mechanical Anchors in Concrete; 2005

B. ASTM A 36 – Standard Specification for Carbon Structural Steel; 2005

C. ASTM A 193 – Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

D. ASTM A 307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength; 2007b

E. ASTM B 633 – Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2007

F. ASTM C 881– Standard Specification Epoxy-Resin-Based Bonding Systems for Concrete; 2002

G. ASTM F 593 – Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2002

H. ASTM F 1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

I. ICC-ES AC193 – Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2008

J. ICC-ES AC308 – Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2008

## 1.5 QUALITY ASSURANCE

A. Post-Installed anchors and related materials shall be listed by one or more of the following agencies, as applicable:

1. ICC Evaluation Service

2. Underwriters Laboratories (UL) and/or Factory Mutual (FM)

3. IAPMO Evaluation Service

## 1.6 SUBMITTALS

A. Product Data: Submit data for proprietary materials, manufacturer's specifications (including finishes and/or materials), Material Safety Data Sheets (MSDS) and installation procedures.

B. Test Reports: ICC-ES or IAPMO-UES listings.

## 1.7 SUBSTITUTIONS

A. Only manufacturers with an ICC-ES or IAPMO listing will be considered for substitution requests.

B. The contractor shall submit for Engineer-of-Record's review, calculations that are prepared & sealed by a registered Professional Engineer demonstrating that the substituted product is capable of achieving the pertinent equivalent performance values of the specified product using the appropriate design procedure and/or standard(s) as required by the Building Code. In addition, the calculations shall specify the diameter and embedment depth of the substituted product.

C. Any increase in material costs for such submittal shall be the responsibility of the contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Expansion Anchors

1. Concrete Wedge Anchors (expansion bolt):
   a. Carbon steel, ASTM B 633, Class SC1, Type I or III.
   b. Stainless steel anchors (where noted): ASTM F 593, Type 303, 304 or 316.
   c. Evaluation report issued by ICC-ES or IAPMO required.
   d. Tested and qualified for performance in cracked and uncracked concrete in accordance with ACI 355.2 and ICC-ES AC193 for all mandatory tests.
   e. Acceptable products include:
      1) Simpson Strong-Tie: Strong-Bolt (ICC-ES ESR-1771).
      2) Simpson Strong-Tie: Strong-Bolt 2 (ICC-ES ESR-3037)
      3) Hilti: Kwik Bolt TZ (ICC-ES ESR-1917).
      4) Powers Fasteners: Power-Stud+SD2 (ICC-ES ESR-2502).
      5) ITW Red Head: Trubolt+ (ICC-ES ESR-2427)

B. Adhesive Anchors

1. Adhesive anchors consist of an insert and an adhesive.

2. Inserts
   a. Threaded Rod Inserts: Provide preparation or configuration as recommended by manufacturer.
      1) Interior Exposure: ASTM A 307, ASTM A 36, ASTM A 193 Grade B7, or ASTM F 1554.

3. Adhesives for Concrete:
   a. Evaluation report issued by ICC-ES or IAPMO required.
   b. Tested and qualified for use in cracked and uncracked concrete in accordance with ICC-ES AC308 for all mandatory and optional seismic tests including creep tests.
   c. Epoxy: ASTM C 881 Type IV, Grade 3, Class B and C.
      1) Acceptable products include:
         (a) Simpson Strong-Tie: SET XP (ICC-ES ESR-2508).
         (b) Simspon Strong-Tie: ET-HP Epoxy (IAPMO ER-241).
         (c) Hilti: RE-500-SD (ICC-ES ESR-2322).
         (d) Powers Fasteners: PE1000+ (ICC-ES ESR-2583).
         (e) Powers Fasteners: PURE110+ (ICC-ES ESR-3298).
         (f) ITW Red Head: EPCON G5 (ICC-ES-ESR-1137).
         (g) ITW Red Head: EPCON C6+ (ICC-ES ESR-3577).
   d. Acrylic: Cartridge type, two-component, acrylic based system dispensed and mixed through a static mixing nozzle supplied by the manufacturer. Minimum physical requirements of ASTM C 881 Type IV, Grade 3, Class A, B and C.
      1) Acceptable products include:
         (a) Hilti: HY-200 (ICC-ES ESR-3187).
         (b) Powers Fasteners: AC100+ (ICC-ES ESR-2582).

(c) Simpson Strong-Tie: AT-XP (IAPMO ER-263).
(d) ITW Red Head: EPCON S7 (ICC-ES ESR-2308).

C. Concrete Screw Anchors

1. Concrete Screw Anchors:
   a. Carbon steel heat-treated or hardened.
   b. Zinc-plated in accordance with ASTM B 633, Class SC1, Type I or equivalent coating.
   c. Evaluation report issued by ICC-ES or IAPMO required.
   d. Tested and qualified for use per ICC-ES AC193 for all mandatory tests.
   e. Acceptable products include:
      1) Simpson Strong-Tie: Titen HD (ICC-ES ESR-2713).
      2) Hilti: HUS-EZ (ICC-ES ESR 3027).
      3) Powers Fasteners: Wedge-Bolt+ (ICC-ES ESR-2526).
      4) ITW Red Head: Tapcon/Sammy (ICC-ES ESR-2202).

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Install anchors in strict accordance with manufacturer's printed instructions and, where required, requirements of ICC-ES evaluation reports.

B. Conform to manufacturer's requirements for, but not limited to, hole drilling methods, hole size, hole cleaning, substrate and adhesive temperatures, moisture presence in holes, and required edge distance and spacing.

C. Use special tools when recommended by manufacturer for installation of anchors unless otherwise permitted specifically by the Engineer or Architect of Record.

D. Drill holes in concrete, in accordance with the manufacturer’s recommendations.

### 3.2 FIELD QUALITY CONTROL

A. Manufacturer shall, on request, provide the services of a field representative to demonstrate to and train installers in proper installation techniques.

B. Structural Testing and Special Inspection

1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 4533.

2. Special Inspection, periodic or continuous, of post-installed anchors shall be provided as specified herein, but not less than as required by ICC-ES evaluation reports.

3. Definitions: ASNT - American Society for Non-Destructive Testing

4. Personnel Qualifications
    a. Special Inspector Technical I: ASNT Level I, employed by a testing agency and supervised by an ASNT Level III with a minimum of 10 years experience.
    b. Special Inspector Technical II: ASNT Level II, employed by a testing agency and supervised by an ASNT Level III with a minimum of 10 years experience.
    c. Special Inspector – Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in design of structural systems of the project type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection reports.

5. The Owner will provide the following tests and inspections:
    a. Continuous special inspection during installation to verify materials delivered to site comply with contract documents, bolt type and dimensions, concrete type and compressive strength, pre-drilled hole dimensions and cleaning, embedment, spacing, edge distances, slab thickness, tightening torque, and any other items requiring inspection by product's ICC approval report. Qualifications: Technical II or Structural I.

END OF SECTION

# SECTION 03 2000 - CONCRETE REINFORCING

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

### 1.2 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

### 1.3 RELATED REQUIREMENTS

A. Section 01 4533 - Structural Testing and Special Inspection

B. Section 03 1000 - Concrete Forming and Accessories.

C. Section 03 1510 - Post-Installed Anchors.

D. Section 03 3000 - Cast-in-Place Concrete.

### 1.4 REFERENCE STANDARDS

A. ACI 117 - Standard Specification for Tolerances for Concrete Construction and Materials; 2007

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2010.

C. ACI 315 - Details and Detailing of Concrete Reinforcement; 1999

D. ACI 318 - Building Code Requirements For Structural Concrete and Commentary; American Concrete Institute International; 2011.

E. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2007.

F. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2012.

G. ASTM C881 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2002

H. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

I. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 2009.

J. CRSI (P1) - Placing Reinforcing Bars; Concrete Reinforcing Steel Institute; 2011.

## 1.5 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Shop Drawings: Follow recommended practices of ACI 315. Include size, length, bar schedules, shapes of bent bars, spacing of bars, methods of supporting reinforcing, and location and length of splices. Provide details as necessary to show final position of reinforcement in elements.

## 1.6 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

## 1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver all reinforcement to the Project site bundled, tagged, and marked.

B. Store all reinforcing steel bars, ties, wire fabric, etc., on the site in a manner that will permit access for proper inspection and identification.

C. Do not exceed design capacity of existing construction or formwork.

D. Store reinforcing to avoid contact with mud, grease, or other materials that would affect bond.

E. Special handling for epoxy coated reinforcing to include:

1. Support epoxy-coated bars or bundles of bars to prevent damage to coating during transit.

2. Store epoxy-coated bars on protective cribbing.

3. Lift bundles of epoxy-coated bars at multiple pickup points to minimize bar-to-bar abrasion due to sags in the bundles.

4. Do not drop or drag epoxy-coated bars or bundles of bars.

5. Provide padded contact areas on equipment used for handling epoxy-coated bars.

PART 2 PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).

1. Deformed billet-steel bars.

2. Unfinished.

3. Epoxy coated in accordance with ASTM A 775/A 775M where noted.

B. Reinforcement Accessories:

1. Chairs, Bolsters, Bar Supports, Spacers: CRSI MSP-1 Chapter 3. Sized and shaped for adequate support of reinforcement during concrete placement.
   a. Class 1 for all surfaces exposed to weather.
   b. Class 1 or 2 for interior surfaces exposed to view.
   c. Class 3 for surfaces not exposed to view.

2. Bar Supports and Accessories for epoxy coated bars: CRSI MSP-1 Chapter 3, Class 1A epoxy, vinyl, or plastic coated, all plastic supports, or precast supports with epoxy or plastic coated wire.
   a. Use epoxy-coated reinforcing bars as support bars.
   b. Fasten epoxy-coated reinforcing bars to bar supports, accessories, and each other with nylon, epoxy or plastic coated tie wire.

3. Patching Materials for Epoxy Coated Bars: ASTM D3963 Annex A1, inert in concrete.

4. Mechanical couplers: Develop 125% of yield strength, ICBO approved. Dayton/Richmond: Barlock Coupler System, Erico: Lenton Couplers, or approved equal.

5. Post-installed reinforcing adhesive: See section 03 1510

2.2 DETAILING

A. Detail reinforcing steel in accordance with ACI 315 and ACI 318.

B. Splice reinforcing where indicated on drawings. Specifically note proposed splices not shown on the drawings on the shop drawings and highlight for reviewer's acceptance.

C. Provide epoxy coated reinforcing for all concrete exposed to weather such as exterior walls, slabs, columns, piers, and stoop slabs. Additional locations may be noted on the drawings. Building foundation walls do not require epoxy coated reinforcing unless shown on the drawings.

D. Provide bar supports and other accessories sufficient to maintain reinforcing within specified placing tolerances. Consider requirements of CRSI MSP-1 to be a minimum.

E. Provide bar supports for all reinforcing, including footings, slabs on grade, and slab temperature reinforcing.

F. Consider normal construction activities while detailing number and type of bar supports.

G. Detail reinforcing to accommodate forming, fabricating, and placing tolerances and maintain a minimum cover as specified.

## 2.3 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 318 and ACI 301.

B. Fabricate within tolerances given in ACI 117.

C. Welding of reinforcement is not permitted.

D. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

# PART 3 EXECUTION

## 3.1 PREPARATION - PLAIN BARS

A. Clean all reinforcement before placing. Remove oil, mill scale, pitting, mud, loose rust, strong alkali or organic matter.

B. Remove all excessive rust with wire brush or by sandblasting.

C. Reinforcement with rust and/or mill scale shall be acceptable if a hand-brushed test specimen meets the applicable ASTM requirements for dimension, weight, and height of deformations.

## 3.2 PREPARATION - EPOXY COATED BARS

A. Repair coating damage larger than 0.1 square inch in accordance with patching material manufacturer's recommendations.

B. Remove oil, mud, strong alkali, or organic matter prior to placement in forms.

## 3.3 PLACEMENT

A. Place reinforcing in accordance with approved shop drawings, support and secure reinforcement against displacement. Do not deviate from required position. Place within maximum tolerances given in ACI 117.

B. Splice reinforcing where indicated on drawings.

C. Install mechanical connectors in accordance with connection manufacturer's recommendations.

D. All bars must be placed before concrete is poured.

E. Provide templates for all column dowels.

F. Do not bend bars embedded in hardened or partially hardened concrete without approval from the Architect/Engineer. If bending is permitted, conform to procedures of ACI 301.

G. Support footing and slab on grade reinforcing. Do not lift or "step in" during placement of concrete. Use precast concrete, block, brick, or wire supports with earth bearing bases.

H. Do not displace or damage vapor barrier.

I. Reinforcing shall have the minimum concrete cover as given on the drawings.

## 3.4 INSTALLATION - EPOXY COATED REINFORCING

A. Do not field cut epoxy-coated reinforcing bars unless shown on Drawings or permitted by Engineer.

B. Do not use welded splices of epoxy-coated reinforcing bars unless shown on Drawings or permitted by Engineer. When used, welded splices shall conform to AWS D1.4. Welding of crossing bars (tack welding) for assembly of epoxy-coated reinforcement is prohibited.

C. Provide suitable ventilation when welding of epoxy-coated bars is required or permitted.

D. Do not use mechanical connections for epoxy-coated reinforcing unless shown on drawings or permitted by Engineer.

E. Repair coating damage due to heating, bending, cutting, welding or installation of mechanical connections, in accordance with ASTM D3963 and patching material manufacturer's recommendations.

F. Do not use epoxy-coated bars with damage, repaired and unrepaired, exceeding 2 percent of the surface area of each bar.

## 3.5 POST-INSTALLED REINFORCING

A. See section 03 1510 for installation requirements.

## 3.6 FIELD QUALITY CONTROL

A. Structural Special Inspection

1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 4533.

2. Concrete reinforcing in slabs on grade, footings without transverse reinforcement, and other locations as noted on the structural drawings does not require inspection. Special Inspector need not be present during entire reinforcing installation, but must observe all required reinforcing prior to concrete placement.

3. Personnel Qualifications:
   a. Special Inspector - Structural I: ICBO certified concrete inspector or a graduate civil/structural engineer, or other personnel acceptable to the structural Engineer of Record (SER), with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection reports.

4. The Owner will provide the following inspections:
   a. Inspect reinforcement in all cast in place concrete. Qualifications: Structural I. Verify the following:
      1) Reinforcing bar grade.
      2) Reinforcing bars are free of oil, dirt, excessive rust, and damage.
      3) Reinforcing bars are adequately tied, chaired, and supported to prevent displacement during concrete placement.
      4) Proper chair and tie wire materials are used.
      5) Proper clear distances between bars and to surfaces of concrete.
      6) Reinforcing bar size and placement.
      7) Bar laps for proper length and stagger.
      8) Bar bends for minimum diameter, slope and length.
      9) Mechanical splices are placed in accordance with the plans, specifications and reviewed shop drawings.
      10) Epoxy coating is presented at locations noted in the plans and specifications. include tie wires, chairs, bolsters, etc. Verify coating damaged is repaired in accordance with the contract requirements.

END OF SECTION

# SECTION 03 3000 - CAST-IN-PLACE CONCRETE

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

### 1.2 SECTION INCLUDES

A. Section Includes: Providing all items, articles and materials listed, mentioned, or scheduled on the Drawings or herein, including all labor, materials, equipment, and incidentals necessary and required for the installation of all cast-in-place concrete indicated on the Drawings or specified herein.

B. Concrete footings

C. Floors and slabs on grade.

1. Including vapor barrier.

D. Concrete elevator shaft walls and foundation walls.

E. Joint devices associated with concrete work.

F. Concrete curing.

### 1.3 RELATED REQUIREMENTS

A. Section 01 4533 - Structural Testing and Special Inspection

B. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

C. Section 03 2000 - Concrete Reinforcing.

D. Section 05 1200 - Embedded Structural Steel, Anchor Bolts

### 1.4 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).

C. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010.

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (errata 2007).

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

H. ACI 306.1 - Standard Specification for Cold Weather Concreting, American Concrete Institute; 1990

I. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

J. ACI 308.1 - Standard Specification for Curing Concrete, American Concrete Institute; 1998

K. ACI 309R - Guide for Consolidation of Concrete, American Concrete Institute; 1996

L. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

M. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Billet-Steel Bars for Concrete Reinforcement; 2012.

N. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2003

O. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

Q. ASTM C 157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete; 2006.

R. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method; 1997

S. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

T. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2011.

U. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.

V. ASTM C 1116 - Standard Specification for Fiber-Reinforced Concrete; 2006.

W. ASTM C 1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2007.

X. ASTM C 1399 - Standard Test Method for Obtaining Average Residual Strength of Fiber-Reinforced Concrete; 1998.

Y. ASTM C 1609 - Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading); 2005.

Z. ASTM D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2003

AA. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

## 1.5 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Concrete mix designs for each mix used. On request, include field test data used to determine required average strength (if that method was used) and field test or trial mix data used to document required average compressive strength.

C. Product data for admixtures, curing materials and compounds, joint fillers, fiber reinforcing, vapor retarders, and slab construction joint devices

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Cold weather concreting procedures.

F. Drawings showing construction and control joint locations and details for slabs on grade.

G. Certification of admixture conformance to chloride ion requirements.

H. Field quality control test results.

## 1.6 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Fiber reinforcing supplier shall have no less than five (5) years of satisfactory product performance experience with the approved product.

## 1.7 MATERIAL DELIVERY, HANDLING, AND STORAGE

A. Materials shall be delivered in the Manufacturer's undamaged, unopened containers. Each container shall be clearly marked with the product name, manufacturer's name, batch number, component designation, and ratio of component mixtures.

B. Provide equipment and personnel to handle the materials by methods that prevent damage.

C. Promptly inspect shipments to assure that materials comply with requirements, quantities are correct, and materials are undamaged.

D. Store materials in accordance with the Manufacturer's instructions, with seals and label intact and legible. Maintain temperatures within the Manufacturer's recommended ranges.

E. Furnish delivery tickets with each load of concrete delivered to the Project. Information on each ticket shall be as required by ASTM C94 and shall also include: type of concrete (mix number), weights of all ingredients, maximum aggregate size, type, brand, and amount of admixture, total water in the batch, maximum amount of water that can be added at the site without exceeding design mix proportions, and amount of water added at site and initials of person adding water. Retain tickets until substantial completion unless directed otherwise.

# PART 2 PRODUCTS

## 2.1 FORMWORK

A. Comply with requirements of Section 03 1000.

## 2.2 REINFORCEMENT

A. Comply with requirements of Section 03 2000.

## 2.3 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Fine and Coarse Aggregates: ASTM C 33.

1. Maximum aggregate size is specified in mix design schedule.

C. Fly Ash: ASTM C618, Class C or F.

D. Water: Clean and not detrimental to concrete.

E. Synthetic Micro Fiber Reinforcing: 100% virgin polyolefin (polypropylene or polyethylene), fibrillated, graded or minimum ¾" uniform length, ICC approved, ASTM C1116, Type III. Fibermesh 300: Propex Concrete Systems, Grace Fibers: W.R. Grace, Ultra-Net: Forta Fibers, and approved equal.

## 2.4 **ADMIXTURES**

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

D. Water Reducing Admixture: ASTM C494/C494M Type A.

E. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than.05% chloride ions.

F. Do not use accelerating or retarding admixtures without written approval of the Architect.

## 2.5 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single ply polyethylene is prohibited. Include manufacturer's recommended joint sealing tape.

1. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor retarder.

B. Granular fill over vapor retarder: Clean mixture of crushed aggregates and sand, ASTM D448, size 10, with 85-100% passing the No.4 sieve and 10-30% passing the No. 100 sieve. Meet requirements of ASTM C33 for deleterious substance limits in fine aggregates.

## 2.6 BONDING AND JOINTING PRODUCTS

A. Slab Isolation Joint Filler: 1/4 inch (6 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.

## 2.7 CURING MATERIALS

A. All curing agents and sealers shall have no adverse affect on finishes, traffic topping, or other sealers. Coordinate with the appropriate finish manufacturer and receive written confirmation before applying.

B. Moisture-Retaining Cover: ASTM C 171; regular curing paper, white curing paper, white polyethylene film at temperatures above 60 degrees F., black polyethylene film at temperatures below 80 degrees F., clear polyethylene, or white burlap-polyethylene sheet at temperatures above 60 degrees F.

C. Curing and Sealing Compound: ASTM C1315, Type 1, Class A, VOC compliant, 25% minimum solids.

D. Exterior Concrete Curing Compound: Wax base, membrane forming curing compound, ASTM C309, Type II, white pigmented.

E. Water: Potable, not detrimental to concrete.

## 2.8 CONCRETE MIX DESIGN REQUIREMENTS

A. Submit concrete mix design for each type of concrete at least 30 days prior to the proposed start of placement. Mix designs must be reviewed prior to pouring concrete. Review is for conformance with specification requirements only. Contractor is responsible for performance.

B. Concrete shall conform to the requirements of ASTM C94 (Option A) unless other requirements of this project specification are more stringent.

C. Provide concrete with workability such that it will fill the forms, without voids or honeycombs, when properly vibrated, without permitting materials to separate or excess water to collect on the surface.

D. Slump at point of discharge: 5" max. for concrete without superplasticizer and 9" max. for concrete with superplasticizer.

E. Proportioning Normal Weight Concrete: ACI 301. Establish proportions based on the standard practices contained in ACI 211.1.

F. Determine required average strength as required by ACI 301.

G. Concrete Strength: Document that mixes produce required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

H. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

## 2.9 CONCRETE MIX DESIGN SCHEDULE

A. Normal Weight Concrete: Footings

1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 3,000 psi.

2. Water-Cement Ratio: Maximum 0.62 by weight.

3. Maximum Aggregate Size: 1-1/2" Class 1S.

4. Maximum Chloride Ion Content: 0.30 percent by weight of cement.

B. Normal Weight Concrete: Walls not exposed to view

1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

2. Water-Cement Ratio: Maximum 0.52 by weight.

3. Maximum Aggregate Size: 3/4" Class 1S.

4. Maximum Chloride Ion Content: 0.30 percent by weight of cement.

C. Normal Weight Concrete: Freestanding columns

1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,500 psi.

2. Water-Cement Ratio: Maximum 0.45 by weight.

3. Total Air Content: 4-1/2% to 7-1/2% percent, determined in accordance with ASTM C231.

4. Maximum Aggregate Size: 3/4" Class 1S.

5. Maximum Chloride Ion Content: 1.00 percent.

D. Normal Weight Concrete: Exterior Concrete

1. Exterior concrete includes: exterior aprons and stoop slabs.

2. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,500 psi.

3. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.

4. Synthetic Micro Fiber Reinforcement: Add to mix as recommended by manufacturer for specific project conditions. Minimum rate of 1.5 pounds per cubic yard (0.89 kg per cubic meter). Minimum residual strength per ASTM C1399 or C1609: 45 psi. Required at slabs only.

5. Water-Cement Ratio: Maximum 0.40 by weight.

6. Total Air Content: 4-1/2% to 7-1/2% percent, determined in accordance with ASTM C231.

7. Maximum Aggregate Size: 3/4" Class 4S.

8. Maximum Chloride Ion Content: 0.15 percent by weight of cement.

E. Normal Weight Concrete: Slabs on grade

1. Minimum Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days: 4,000 psi.

2. Synthetic Micro Fiber Reinforcement: Add to mix as recommended by manufacturer for specific project conditions. Minimum rate of 1.5 pounds per cubic yard (0.89 kg per cubic meter). Minimum residual strength per ASTM C1399 or C1609: 45 psi.

3. Water-Cement Ratio: Maximum 0.45 by weight.

4. Maximum Aggregate Size: 3/4" Class 2S, well graded to achieve shrinkage limits specified.

5. Maximum 28-day shrinkage per ASTM C157: 0.05%

6. Maximum Chloride Ion Content:.30 percent by weight of cement.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

### 3.2 PREPARATION

A. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

B. Do not embed pipes other than non-aluminum electrical conduit or snow melting pipes in any structural concrete.

1. Any pipes embedded in concrete, even those meeting the guidelines given herein, are subject to acceptance by Architect. Remove any unacceptable pipes.

2. Outside diameter of pipes placed in slabs and walls shall not exceed 25% of the thickness of the slab or wall and shall be placed in groups of not more than 3. Space pipes within a group at not less than 4 diameters clear. Space groups of pipes at not less than 48 diameters clear.

3. Maximum total dimension or area of pipes and their fittings embedded in concrete beams and columns shall not exceed, at any location, 15% of least section dimension or 4% of the gross cross sectional area.

C. Where new concrete is to be bonded to existing or previously placed concrete, clean existing surface to remove dust, dirt, grease, oil, curing compounds and other items that would be detrimental to bonding. Saturate existing surface with clean water (8 hours minimum), remove excess water, and slush with a neat cement grout immediately before placing new concrete.

D. Protect existing concrete work to be exposed to view and other finished materials from damage and staining resulting from concreting operations. Cover sills, ledges and other surfaces with protective coverings as necessary to protect the work.

E. Slabs on Grade:

1. Verify subgrade compaction tests have been performed and are accepted.

2. Verify subgrade is level and within acceptable tolerances.

3. Verify subgrade is substantially dry with no freestanding water, muddy spots, or soft spots and is free from snow or ice.

4. Do not lay vapor retarders below granular fill until the roofing has been installed and building has been inclosed.

5. Verify completion of all underfloor mechanical and electrical work.

6. Provide 3 inch minimum cover bottom and 3 inch minimum cover sides at electrical conduits and other embedded items.

7. Lay vapor retarder per ASTM E1643 and manufacturer's written instructions for interior slabs on grade. Lap joints 6" minimum and seal. Provide boots and seal at all penetrations. Adhere to perimeter walls. Place 4" minimum of granular fill over vapor retarder and compact. Repair damaged vapor barrier prior to placing fill.

## 3.3 CONCRETE MIXING

A. Transit Mixers: Comply with ASTM C 94/C 94M.

B. Use cooled or heated water in accordance with ACI 306 and 305.

C. Air-entraining and chemical admixtures, if approved, shall be charged into mixer as a solution and dispensed by an automatic dispenser or similar metering device. Powdered admixtures shall be weighted or measured by volume as recommended by the manufacturer. Superplasticizer may be added at the job site to maintain slump.

D. Two or more admixtures may be used in same concrete, provided such admixtures are added separately during batching sequence. Admixtures used in combination shall retain full efficiency and have no deleterious effect on concrete or on properties of each other.

E. For fiber reinforced concrete, introduce fibers to mix when recommended by fiber supplier to maximize disbursement through the mix and to minimize balling of fibers.

F. Ready mixed concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of rated capacities. Schedule and dispatch trucks from the batching point so that they shall arrive at the site of the work just before the concrete is required to avoid excessive mixing of concrete while waiting.

G. Discharge at the site shall begin within one (1) hour after charging. Concrete may be used as long as it is of such slump that it can be placed and properly consolidated without the addition of water to the batch (other than water added prior to the start of discharge as given below). If elapsed time since batching exceeds 90 minutes, or if drum has revolved more than 300 revolutions since batching, test air content, slump, and temperature for conformance to this specification prior to placing. In no case shall the time between batching and complete discharge exceed 120 minutes. Do not permit retempering of concrete. Discard concrete that has obtained its initial set.

H. Do not add water after the initial introduction of the mixing water for the batch, except at the start of discharge, subject to the conditions below. In this case, the producer may add water in an amount not exceeding that allowed to achieve the design water/cement ratio. The drum blades shall then be turned an additional 30 revolutions minimum at mixing speed. Water shall not be added to the batch at any later time. Reject concrete if water is added and these conditions are not met.

1. The measured slump of the concrete is less than that specified in the mix design.

2. No more than 60 minutes have elapsed from the time of batching.

3. The ready-mix plant is notified and approves.

4. Truck tickets indicate maximum amount of water to be added.

5. Water is added in a manner to control volume.

6. Special Inspector is notified, if concrete placement requires inspection.

I. Maximum concrete temperature delivered to Project site shall be 85 degrees F.

J. To use materials other than those accepted originally, or if the materials from the source originally accepted change in characteristics, make additional tests with proposed new materials that will verify production of concrete meeting with the stated requirements without causing objectionable change in the color or appearance of the structure. Pay the testing agency for these additional tests. Do not use concrete made from such different materials until the Architect has given his approval.

K. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished by the Vendor, the Architect may order such changes in the proportions or materials, or both, as may be necessary to secure the desired properties, subject to the stated requirements. Make any changes so ordered without extra compensation.

## 3.4 PLACING CONCRETE

A. Place concrete in accordance with ACI 301. Follow recommended practice of ACI 304R.

B. Place concrete for floor slabs following recommended practices of ACI 302.1R.

C. Do not place in rain, sleet or snow unless exposed concrete surface is protected from moisture.

D. If, for any reason, the concrete pour is delayed for more than 45 minutes, bulkhead pour at last acceptable construction joint. Immediately remove excess concrete and clean all forms and in situ concrete surfaces.

E. Do not permit concrete to drop more than 4 feet from its point of release to mixers, hoppers, or conveyances. Use tremmies, chutes, or pumps as necessary to place columns and walls.

F. Deposit concrete in wall forms in layers not greater than 24 inches in depth. Consolidate each layer before the succeeding layer is placed.

G. Place concrete as near as possible to its final position to prevent segregation. Do not use vibrators to transport concrete.

H. Do not interrupt successive placement; do not permit cold joints to occur.

I. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

J. Immediately remove concrete spilled on existing surfaces.

K. Concrete at tops of forms: Strike concrete at top of wall, footing, and pier forms. Smooth and float to texture comparable to adjacent formed surfaces.

L. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

## 3.5 JOINTS

A. Vertical construction joints in walls shall be a maximum of 80 feet on center and shall be located as shown on structural drawings. Vertical control joints in wall shall be a maximum of 20 feet on center between construction joints and shall be located as shown on the structural drawings. If locations are not shown, locate joints at edges of piers integral with wall and near corners and in concealed locations where possible.

B. Horizontal joints in walls and columns shall be at underside of slabs, beams and girders and at top of footings. At least 24 hours shall elapse between placing concrete in a wall or column and placing concrete in an area supported by the wall or column.

C. Reinforcing shall be continuous across construction joints. Provide dowels where detailed or requested. Joints in walls shall be keyed with longitudinal keys at least 1-1/2 inches deep unless detailed otherwise.

D. Where new concrete is to be placed against concrete that has set, roughen and clean the existing surfaces. Thoroughly wet the existing surfaces and slush with a neat cement grout immediately before placing new concrete.

## 3.6 SLAB JOINTING

A. Locate slab on grade construction and control joints as given on Drawings and submit drawings showing proposed locations. Cut joints as soon as concrete has hardened sufficiently to prevent aggregate dislodgement. Use a "Soff Cut" saw to cut to a depth of 1 1/4" immediately after final finishing. Use a conventional saw to cut to a depth of one-fourth the slab thickness or as shown on the drawings. Complete sawing within 12 hours of placement.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

## 3.7 CONSOLIDATION

A. Consolidation of concrete shall conform to ACI 301, unless modified herein.

B. Follow recommended practices of ACI 309, unless modified herein.

C. Consolidate concrete using internal vibrators.

D. Maintain a spare vibrator at the Project Site during all placing operations.

## 3.8 CONCRETE FINISHING

A. Concrete Finish Schedule

1. Concealed walls, columns, and slabs: As-cast rough form finish.

2. Exposed interior concrete floors and floors to receive carpeting: Troweled finish.

3. Exterior platforms and aprons: Broom finish.

4. Floors to receive thin-set ceramic tile, resilient flooring, and vinyl tile: Flat troweled finish.

B. Formed Surfaces

1. Repair surface defects, immediately after removing formwork.

2. Provide finishes per ACI 301 as scheduled and to the following tolerances.

3. Rough Form Finish: Rub down or chip off fins or other raised areas 1/2 inch (__ mm) or more in height. Rough form finish per ACI 301. Class C surface per ACI 117.

C. Unformed Surfaces

1. Provide finishes per ACI 301 as scheduled herein or noted on Drawings and to the following tolerances.
   a. Troweled Finish: Moderately flat tolerance per ACI 117. Slope slab to floor drains.
   b. Flat Troweled Finish: Flat tolerance per ACI 117
   c. Broom Finish: Moderately flat tolerance per ACI 117.

2. Clean exposed concrete to remove laitance, efflorescence and stains.

## 3.9 CURING AND PROTECTION

A. Comply with requirements of ACI 308.1 as amended by this section. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature above 55° F for the period necessary for hydration of cement and hardening of concrete as follows:

1. Normal concrete: Not less than 7 days.

C. Curing may be terminated earlier than the minimum time above if at least one of the following conditions is met:

1. At least 4 field cylinders for each pour, prepared and cured according to ASTM C31 alongside the concrete they represent, reach 70% of the specified 28-day strength.

2. The concrete temperature is maintained above 50°F and laboratory cylinders reach 85% of the specified 28-day strength.

D. Formed Surfaces: Cure by moist curing with forms in place for full curing period. If forms are removed during the curing period, cure by one of the methods specified for unformed surfaces.

1. Keep steel forms heated by the sun and all wood forms wet during the curing period.

E. Unformed Surfaces: Apply curing materials as soon as finishing operations are complete and the concrete's sufficiently hard to be undamaged by the curing process.

1. Waterproof paper or polyethylene film: Use appropriate color of film based on ambient temperature. Sprinkle concrete with water as necessary during application of covering. Lap edges and ends at least 6 inches, and seal laps. Weight down covering to prevent movement. Patch holes and tears that occur during the curing period.

2. Curing Compounds: Apply strictly according to the manufacturer's instructions using low pressure spray equipment.
   a. Maximum 300 square feet per gallon for curing and sealing compound.

3. Use the following methods:
    a. Interior floors exposed in the finished work: Cure using a curing and sealing compound.
        1) For surfaces exposed in the finished work, provide a second coat of acrylic curing and sealing compound immediately prior to substantial completion. Clean floors, and apply sealer strictly according to manufacturer's instructions.
    b. Interior surfaces receiving adhesive applied finishes: Cure using wet curing methods or by covering with waterproof paper or polyethylene film.
        1) Curing and sealing compound may be used upon receipt of a letter from the adhesive manufacturer that this compound is compatible with the adhesive.
    c. Exterior concrete: Cure using exterior concrete curing compound.
    d. All other unformed surfaces: Cure using a strippable curing compound, by wet curing methods, or by covering with waterproof paper or polyethylene film.

4. Protect concrete from excessive changes in temperature during the curing period and at the termination of the curing process. Changes in the temperature of the concrete shall be as uniform as possible and shall not exceed 5° F in any one hour or 50° F in any 24 hour period.

## 3.10 HOT WEATHER CONCRETING

A. Apply recommended practices of ACI 305R when wind, temperature and humidity conditions cause evaporation rates (using Figure 2.1.5 of ACI 305R) exceeding the following:

1. 0.2 lb/sq ft/hr for concrete with Portland cement only.

2. 0.1 lb/sq ft/hr for concrete with Portland cement and fly ash.

3. 0.05 lb/sq ft/hr for concrete with Portland cement and silica fume.

B. Determine and document expected evaporation rate for the duration of concrete pour.

C. Wet or fog forms and reinforcing immediately prior to placement to bring temperature to ambient conditions.

D. Maintain surface moisture during the period immediately after placement and before final finishing by using wind breaks, fog sprayers, evaporation retarders, or shade (individually or in combination) to prevent plastic shrinkage cracking.

1. Use evaporation retarders according to manufacturer's instructions. Do not use as a finishing aid.

## 3.11 COLD WEATHER CONCRETING

A. Concrete placed during cold weather shall conform to the requirements of ACI 306.1.

B. Cold weather is defined as 3 or more successive days when the average daily outdoor temperature is less than 40 degrees F.

C. All surfaces, including subgrade and reinforcing shall be above 35 degrees F. prior to placing concrete. Surfaces shall not be more than 10 degrees warmer than the minimum concrete temperatures required by ACI 306.1.

D. Maintain cold weather protection for the following duration but not less than the duration specified in "Curing and Protection" above:

1. Maintain protection for a minimum of 48 hours after placement of concrete.

2. Maintain protection for columns and supported slabs until at least 4 field cylinders, prepared and cured in accordance with ASTM C31, reach 85 percent of the specified 28-day strength, or, laboratory cured cylinders reach the specified 28-day strength.

E. Submit detailed procedures for cold weather concreting for engineer's information only.

F. Follow recommended practices of ACI 306R. Subject to other requirements of this section, a non-chloride accelerator may be used to normalize initial set and for early strength gain.

## 3.12 FIELD QUALITY CONTROL

A. Provide free access to concrete operations at project site and cooperate with appointed firm.

B. Structural Testing and Special Inspection

1. Structural Testing and Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provisions of Section 01 4533.

2. Personnel Qualifications
   a. Testing Technician: Technical I - ACI Certified Concrete Field Testing Technician, Grade I, employed by a testing laboratory with C.C.R.L. certification at the National Bureau of Standards, under the direct supervision of a licensed civil/structural engineer. The licensed engineer shall review and approve all reports.
   b. Special Inspector – Structural I: ICBO Certified Concrete Inspector, ACI Concrete Construction Inspector, or a graduate civil/structural engineer, or other personnel acceptable to the Structural Engineer of Record (SER), with experience in the design of structural systems of this type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection reports.

3. The Owner will provide the following tests and inspections:
   a. Tests for cast in place concrete. Qualifications: Technical I.
      1) Compression test specimens: ASTM C31. One set of four standard cylinders of concrete for each compressive strength test. Mold and store cylinders for laboratory cured specimens.

2) Compressive strength tests: ASTM C39. One set of four cylinders for each day's pour between one and 25 cubic yards. If a day's pour exceeds 25 cubic yards, one set of four cylinders for each additional 50 cubic yards, or fraction thereof. One specimen tested at 7 days for information, two at 28 days for acceptance, and one specimen retained in reserve for later testing if required. (When frequency of testing will provide less than five strength tests for a given class of concrete, conduct at least five strength tests from randomly selected batches. If fewer than five batches are used, conduct one test from each batch.)
3) Slump: ASTM C143. One test at point of discharge for each set of compression test specimens; additional tests when concrete consistency appears to have changed.
4) Air entrainment: ASTM C231. Test the first batch of air entrained concrete and one additional test for each set of compression test specimens.
5) Concrete temperature: Test hourly when air temperature is below 40°F or above 80°F and each time a set of compression test specimens is made.

b. Concrete mix verification. Qualifications: Technical I. Verify the following:
1) Mixer truck trip ticket conforms to approved mix design.
2) Total water added to mix on site does not exceed that allowed by concrete mix design.
3) Concrete quality is indicative of adequate mixing time, consistency, and relevant time limits.

c. Observe preparation for and placement of all concrete, excluding slabs on grade and strip footings without transverse reinforcement. Additional exclusions may be noted on the structural drawings. Special Inspector must be present during entire concrete pour. Qualifications: Structural I. Verify the following:
1) Acceptable general condition of concrete base prior to placement.
2) Concrete conveyance and depositing avoids segregation and contamination.
3) Concrete is properly consolidated.
4) Reinforcement remains at proper location.

d. Observe protection and curing methods for all concrete, excluding slabs on grade and strip footings without transverse reinforcement Additional exclusions may be noted on the structural drawings. Observations to be made periodically during the curing period. Qualifications: Structural I. Verify the following:
1) Specified curing procedures are followed.
2) Specified hot and cold weather procedures are followed.

e. Observe all bolts installed in concrete. Qualifications: Structural I. Verify the following:
1) Specified size, type, spacing, configuration, embedment, and quantity.
2) Proper concrete placement and consolidation around all bolts.

C. Contractor Requirements:

1. Provide services of an independent laboratory to perform the following:
a. Make and test additional cylinders to determine time for form removal.
b. Make and test additional cylinders to determine termination of curing procedures.
c. Make and test additional cylinders to determine termination of cold weather practices.

2. Provide the services of a qualified technical representative to instruct the construction team in proper batching, mixing, placement, and finishing of fiber reinforced concrete.

D. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

## 3.13 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Acceptance criteria for concrete strength tests shall be as outlined in section 5.6 of ACI 318. If concrete does not meet acceptance criteria, investigation generally following the provisions of section 5.6.5 of ACI 318 will be used at the discretion of the Structural Engineer of Record. Contractor shall reimburse Owner for all costs associated with this investigation. If, in the judgment of the Structural Engineer of Record, the structural adequacy cannot be shown by this investigation, the Contractor shall remove and replace the concrete in question.

## 3.14 CLEAN-UP

A. Perform concrete washout only in designated area as required by either Division 31 section Erosion Control or the project NPDES permit.

END OF SECTION

# SECTION 035300 - CONCRETE TOPPING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Emery-aggregate concrete topping and patching.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product test reports.

## PART 2 - PRODUCTS

### 2.1 CONCRETE TOPPINGS

A. Emery-Aggregate Concrete Topping: Factory-prepared and dry-packaged mixture of graded, crushed emery aggregate; portland cement or blended hydraulic cement; plasticizers; and other admixtures to which only water needs to be added at Project site.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ARDEX K-15 (interior concrete deck applications).
b. ARDEX OVP finishing compound (interior and exterior concrete wall patching).
c. ARDEX SD-F Feather Finish (interior concrete deck applications).
d. MAPEI Quick Patch (interior or exterior concrete deck patching).

2. Compressive Strength (28 Days): 4,000 psi.

### 2.2 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

2.3 RELATED MATERIALS

A. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of 80 per ASTM D 2240.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

C. Portland Cement: ASTM C 150, Type I or II.

D. Sand: ASTM C 404, fine aggregate passing No. 16 (1.18-mm) sieve.

E. Water: Potable.

F. Acrylic-Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

G. Epoxy Adhesive: ASTM C 881/C 881M, Type V, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements.

2.4 MIXING

A. Topping: Mix concrete topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PREPARATION

A. Existing Concrete: Remove existing surface treatments and deteriorated and unsound concrete. Mechanically abrade base slabs to produce a heavily scarified surface profile with an amplitude of 1/4 inch (6 mm).

1. Prepare and clean existing base slabs according to concrete floor topping manufacturer's written instructions. Fill voids, cracks, and cavities in base slabs.
2. Expose rusting reinforcing bars by drilling, sandblast and epoxy coat rebar. Add sand to epoxy finish before drying.
3. Saw cut contraction and construction joints in existing concrete to a depth of 1/2 inch (13 mm) and fill with semi-rigid joint filler.

B. Install joint-filler strips where topping abuts vertical surfaces.

3.2 FLOOR TOPPING APPLICATION

A. Start floor topping application in presence of manufacturer's technical representative.

B. Monolithic Floor Topping: After textured-float finish is applied to fresh concrete of base slabs, place concrete floor topping per manufacturer’s written instructions.

C. Existing Concrete: Apply bonding adhesive recommended by floor topping manufacturer, mixed according to manufacturer's written instructions, and scrub into dry base slabs to a thickness of 1/16 to 1/8 inch (1.6 to 3 mm), without puddling. Place floor topping while adhesive is still tacky.

D. Place concrete floor topping continuously in a single layer, tamping and consolidating to achieve tight contact with bonding surface. Do not permit cold joints or seams to develop within pour strip.

1. Screed surface with a straightedge and strike off to correct elevations.
2. Slope surfaces uniformly where indicated.
3. Begin initial floating using bull floats to form a uniform and open-textured surface plane free of humps or hollows.

E. Finishing: Consolidate surface with hand or power-driven floats as soon as concrete floor topping can support equipment and operator. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until concrete floor topping surface has a uniform, smooth, granular texture.

1. Hard Trowel Finish: After floating surface, apply first trowel finish and consolidate concrete floor topping by hand or power-driven trowel without allowing blisters to develop. Continue troweling passes and restraighten until surface is smooth and uniform in texture.

F. Construction Joints: Construct joints true to line with faces perpendicular to surface plane of concrete floor topping, at locations indicated or as approved by Architect.

G. Contraction Joints: Form weakened-plane contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete floor topping when cutting action will not tear, abrade, or otherwise damage surface and before random contraction cracks develop.

1. Form joints in concrete floor topping over contraction joints in base slabs, unless otherwise indicated.
2. Construct contraction joints for a depth equal to one-half of concrete floor topping thickness, but not less than 1/2 inch (13 mm) deep.

## 3.3 PROTECTING AND CURING

A. General: Protect freshly placed concrete floor topping from premature drying and excessive cold or hot temperatures.

B. Begin curing immediately after finishing concrete floor topping. Cure by one or a combination of the following methods, according to concrete floor topping manufacturer's written instructions:

C. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

3.4 JOINT FILLING

A. Prepare and clean contraction joints and install semi rigid joint filler, according to manufacturer's written instructions, once topping has fully cured.

3.5 REPAIRS

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

END OF SECTION 035300

# SECTION 035400 - GYPSUM CEMENT UNDERLAYMENT
(Gyp-Crete 2000 in areas under carpet)

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Description of Work: Work of this section includes underlayment for interior finish flooring and is not limited to the following

1. Maxxon Gyp-Crete Floor Underlayment covering normal project conditions and applications.
2. Division 3 Section-Concrete: “Cast Underlayment” and “Gypsum Cement Underlayment”
3. Division 9 Section-Finishes: “Acoustic Treatment”

### 1.2 REFERENCES

| | | |
|---|---|---|
| A. | WBENC | WBENC Certified Business Enterprise www.maxxon.com |
| B. | Underwriters Laboratory | Fire Resistance Volume 1 www.ul.com |
| C. | GREENGUARD Certified | GREENGUARD Certified and GREENGUARD Gold Certified www.greenguard.org |
| D. | ASTM E336 and E1007 | Field Sound Transmission Class (F-STC), Field Impact Insulation Class (F-IIC) |
| E. | ASTM E90 and E492 | Sound Transmission Class (STC), Impact Insulation Class (IIC) |
| F. | ASTM C472M | Compressive strength of gypsum concrete |
| G. | ASTM F2170 | Standard Test Method for Determining Relative Humidity in Concrete Floor Slab |
| H. | ASTM F2419 | Standard Test Method for Installation of Thick Poured Gypsum Concrete and Preparation of Surface to Receive Resilient Flooring |
| | ASTM F2678 | Standard Practice for Preparing Panel Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring |

I. TCNA F 180 — Tile Council of North America Installation Handbook
www.tileusa.com

J. NWFA — National Wood Flooring Association Instructions
www.nwfa.org

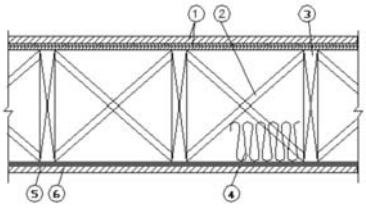
K. Finished Floor Goods Procedures — Maxxon Procedures for Attaching Finished Floor Goods to Maxxon Underlayments
www.maxxon.com

1.3 SUBMITTALS

A. Product Data: Submit sale sheets Gyp-Crete Sales Sheet, Acousti-Mat Ultimate Sound Control Systems, Procedures for Attaching Finished Floor Goods to Maxxon Underlayments, and Maxxon's Building Conditions Guide with project materials clearly identified for each required product or system.

B. UL Directory Fire Resistance Volume 1

| Rating | Underwriters Laboratory File Number |
|---|---|
| 1 Hr Fire Rating | L593 |




Example: L593

C. Acoustical Data: Submit sound tests according to IBC code criteria ASTM E492 (IIC) and ASTM E90 (STC) or ASTM E1007 (F-IIC) and E336 (F-IIC).

D. Code Approvals: See www.maxxon.com for the current list of code approvals.

1.4 SYSTEM REQUIREMENTS

A. Performance Requirements:

1. Gyp-Crete Floor Underlayment (Always a "Green" building material)
   a. Compressive strength up to 2,200 psi (up to 15 MPa)
   b. Density 110 pounds per cubic foot (1,762 kg/$m^3$)
2. Sound Control – 2009 International Building Code: Section 1207.2 & .3
   a. Minimum Sound Transmission Class, 50 STC (45 if field tested) – Section 1207.2
      1) ASTM E90 and E336
   b. Minimum Impact Insulation Class, 50 IIC (45 if field tested) – Section 1207.3
      1) ASTM E492 and E1007

1.5 QUALITY ASSURANCE

A. Performance Standards:

1. All materials, unless otherwise indicated, shall be manufactured by Maxxon Corporation and shall be installed in accordance with its current printed directions and by a Maxxon Corporation Authorized Applicator.
2. Underlayment mix shall be tested for a slump using a 2" (i.d.) x 4" (50 mm x 101 mm) cylinder resulting in a patty size of 8 1/2” (216 mm) plus or minus 1 inch (25 mm) diameter.
3. Compressive strength tested in accordance with ASTM C 472M.

1.6 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in their original unopened packages and protected from damage and exposure from the elements. Damaged or deteriorated materials shall be removed from the premises.

1.7 PROJECT CONDITIONS

A. Before, during and after installation of product, building interior shall be enclosed, with adequate ventilation and heat maintained at a temperature above 50 °F (10 °C) to allow for drying of product.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Manufacturer: Maxxon Corporation, Hamel, MN. Telephone: (800) 356-7887.

2.2 MATERIALS

A. Proprietary products/systems: Poured flooring underlayment and topping products, including the following:

1. Gyp-Crete Floor Underlayment

B. Proprietary products/systems: Optional Sound Control that does not negate the fire rating and is specified in UL design. Acoustical performance is dependent on system design and construction.

1. Acousti-Mat® II HP Sound Mat

C. Maxxon Floor Primer:

1. Material Standard: Comply with specifications outlined in manufacturer's Design and Installation Guide for wood.

D. Mix Water:

1. Material Standard: Potable, free from impurities and from a domestic source.

E. Sand Aggregate:

1. Sand shall meet Maxxon Sand Specification 101.

F. Maxxon Overspray Primer Sealer:

1. Seal all areas that receive glue down floor goods with Maxxon Overspray according to manufacturer's specifications.

G. Maxxon Acrylic Primer Sealer (Alternate to Overspray):

1. Seal all areas that receive glue down floor goods with Maxxon Acrylic according to manufacturer’s specifications.

H. Maxxon Reinforcement or Maxxon CSM (Crack Suppression Mat):

1. If reinforcement in the Maxxon underlayment is needed or required.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Site Verification of Conditions:

1. Installation shall not begin until the building is enclosed, including roof, windows, doors, and any other apertures.
2. Wood substrate shall be structurally sound, properly fastened, and dry. Contractor shall clean subfloor to remove mud, oil, grease, and other contaminating factors before arrival of the authorized applicator.
3. Wood substrate:
   a. The wood subfloor must be adequate to withstand live and dead loads with a deflection limitation of L/360.
   b. Wood should be agency approved 23/32” (1.8cm) T & G subfloor sheathing.

### 3.2 REQUIREMENTS

A. Leak Prevention:

1. Fill cracks and voids in subfloor where leakage of slurry could occur.

B. Priming subfloor:

1. Prime substrate according to manufacturer's recommendations.

C. Application:

1. Install in accordance with reference standards and manufacturer's instructions.

## 3.3 GENERAL INSTALLATION REQUIREMENTS

A. Mixing Proportions:

1. General Requirements: Mix proportions and methods shall be in strict accordance with product manufacturer recommendations.

B. Application:

1. (Optional) Acousti-Mat Installations: Install Acousti-Mat following manufacturer's recommendations and specifications
2. Pour floor topping to recommended thickness. Immediately spread and screed product to a smooth surface. Expansion joints in all types of work shall be brought through the underlayment.
   a. Minimum Maxxon Underlayment Depth:

| Substrate | Depth of Pour |
|---|---|
| Wood | ¾” (1.9 cm) |
| Acousti-Mat II HP | 1” (2.5 cm) |

C. Drying:

1. The general contractor must provide and maintain correct environmental conditions to keep the building clean and dry, and protect against infestation of moisture from a variety of potential sources. The general contractor must supply mechanical ventilation and heat if necessary to remove moisture from the area until the Gyp-Crete is dry.
2. Protection from Heavy Loads: During construction, place temporary wood planking over Gyp-Crete wherever it will be subject to heavy wheeled or concentrated loads.

## 3.4 PREPARATION FOR INSTALLATION OF GLUE DOWN FLOOR GOODS

A. Sealing:

1. Seal all areas that receive glue down floor goods with Maxxon Overspray or Maxxon Acrylic according to the Maxxon Corporation's specifications. Any floor areas where the surface has been damaged shall be cleaned and sealed regardless of floor covering to be used. Where floor goods manufacturers require special adhesive or installation systems, their requirements supersede these recommendations.
2. Maxxon UWR can be used over Maxxon underlayments in low traffic areas such as utility rooms, storage rooms and closets, as a protective surface.

B. Moisture Testing:

1. ASTM F2170 Test Method for Determining Relative Humidity in Concrete. Follow the respective floor goods manufacturers’ recommendations for relative humidity requirements. When manufacturer does not have a relative humidity requirement, refer to

Maxxon's *Procedures for Attaching Finished Floor Goods to Maxxon Underlayments* brochure.

C. Finished Floor Goods:

1. There are many reference standards for the installation procedures and recommendations for finished flooring applications over gypsum underlayments. These include instructions of the manufacturers of the finished flooring, adhesives and thin-set as well as national agency reference standards. The national standards are listed below:

| Flooring Type | Reference Standard |
|---|---|
| Resilient | ASTM F2419 |
| Ceramic Tile | TCNA F180 |

END OF SECTION 035400

# SECTION 047300 - SIMULATED/MANUFACTURED STONE

## PART 1 - GENERAL

### 1.1 SECTION INCLUDES

A. Simulated stone assembly installed as wall veneer over scratch coat prepared substrate as indicated on drawings.

### 1.2 RELATED SECTIONS

A. Section 071900 - Water Repellants

B. Section 079200 - Joint Sealants

### 1.3 REFERENCES

A. ACI 530 - Building Code Requirements for Masonry Structures & Specifications for Masonry Structures.

B. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM C 150 - Standard Specification for Portland Cement.

D. ASTM C 778 - Standard Specification for Standard Sand.

E. ASTM C 847 - Standard Specification for Metal Lath.

F. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.

G. IMIAC - International Masonry Industry All-Weather Council: Recommended Practices and Guide Specification for Hot and Cold Weather Masonry Construction.

### 1.4 SYSTEM DESCRIPTION

A. General:

1. A mortar set and grouted veneer simulated stone assembly.

B. Design: Comply with applicable requirements of governing authorities and codes of types of masonry construction shown, except where more stringent requirements are required.

1. Metal Stud Construction: Simulated stone may be applied to metal stud construction, which is a minimum of 18 gauge galvanized metal. Metal studs shall be covered with sheeting material for interior or exterior applications as needed. Metal lath shall be

secured to the studs spaced a maximum of 16” on center with corrosion resistant Number 8 self-tapping screws spaced 6” on center. The screws are to penetrate into the metal studs a minimum of ½”. A scratch coat of mortar is applied into and over the lath. Exterior applications will require a weather resistant barrier; two layers of 15# building paper.

C. Performance:

1. Minimum tested values complying with ICBO Acceptance Criteria for Precast Stone Veneer (AC51) testing standards ICBO Criteria

a. Freeze thaw: 3% loss max.
b. Compressive strength: 1800 psi min.
c. Shear Bond with Scratch Coat: 50 psi min.

## 1.5 SUBMITTALS

A. Submit under provisions of Section 013300.

B. Product data: For each type of product indicated.

C. Product sample for approval.

D. Qualifications: Submit certifications and test reports indicating compliance with Quality Assurance requirements.

## 1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A minimum of five years of experience in the manufacture of simulated stone, and having adequate facilities and capacity to produce the quantity and quality specified in the time frame required.

B. Installer Qualifications: Regularly engaged and experienced in the installation of simulated stone, employing experienced masons.

C. Product Requirements:

1. Independent testing of product required for ICBO certification in compliance with AC51 and meeting physical characteristics specified.
2. Products proposed have been exposed to weather for at least one year without degradation.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Store units off the ground on material that will not stain the stone; if long term storage is necessary, cover with polyethylene or other non-staining waterproof material

1.8 WARRANTY

A. Provide manufacturer's written warranty.

B. Material Warranty: Warrant materials against defects after completion and final acceptance of Work for a period of 30 years. Manufacturer shall furnish, free-of-charge, new materials to replace materials determined to be defective. This material warranty does not include labor for installation.

1. The warranty shall cover only manufacturing defects of the manufactured stone products and does not extend to or cover damage resulting from the following:

a. Settlement of the building or other wall movement.
b. Contact with chemicals, paint, or staining.
c. Discoloration from airborne contaminates, oxidation, or facing associated with the normal aging process.
d. Installation warranty period of one year from substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: As noted on drawings.

B. Requests for substitutions will be considered in accordance with provisions of Section 016300.

2.2 UNITS

A. Simulated Stone: Engineered by manufacturer to achieve specified strength, color, and texture, desired handling characteristics, and resistance to effects of weathering.

1. Thickness: 1 3/4" ± varies.
2. Density: 90 pcf.
3. Compressive Strength: 1800 psi, minimum, at 28 days, when tested in accordance with ASTM C 67.
4. Water Absorption: 18% maximum, when tested in accordance with ASTM C 140.
5. Thermal Resistance: Not less than an R of 0.865.
6. Smoke and Fuel Contribution: UL listed 0/0.
7. Weather Resistance: Mix design proven by experience to be resistant to degradation by weather.

B. Stone Design and gray for Grouted System: Custom color to match existing brick and colors to match Bolder Creek 2103-8 Sienna Blend.

2.3 MATERIALS

A. Pigment: Achieve desired color using only cement and aggregate to extent possible.

1. Limited quantity to 10 percent by weight of cement.
2. Inorganic, natural or synthetic iron oxide pigments complying with ASTM C 979 and guaranteed by manufacturer to be lime proof.

    a. Cement grade carbon black pigment is not permitted.

B. Sand: Masonry sand per ASTM C144, aggregate graded with 100 percent passing No. 16 sieve.

C. Cement: ASTM C 150 Type I, III, and II white Portland cement. Blended by stone manufacturer to meet stone mix requirements.

D. Grout Pigments: Inorganic, natural or synthetic iron oxide pigments complying with ASTM C 979 and guaranteed by manufacturer to be lime proof.

E. Silica Sand: Silica sand per ASTM C778, aggregate containing metal oxides and trace elements specifically engineered and tested by stone manufacturer for stone product characteristics and performance.

F. Lightweight Clay: Lightweight clay aggregate produced using the rotary kiln process and refined per stone manufacturer's requirements.

G. Scratch Coat:

1. 1 part cement type I.
2. 2 parts masonry sand.
3. Clean water.

H. Setting Mortar:

1. 1 part cement type I.
2. 2 parts masonry sand.
3. Clean water.

I. Grout:

1. 1 part cement type I.
2. 2 parts masonry sand.
3. Clean water.
4. Color: Custom; match light colored cultured stone.

J. Lath: Fabricated metal lath from galvanized steel: Structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653, G60 minimum coating designation conforming to ASTM C 847 Diamond Mesh. Corrosion resistant 2.5lb or 3.4lb per square yard galvanized diamond wire metal lath

K. Weather Resistant Barrier: Two layers – Grade D Kraft Waterproofing Building Paper as described in UBC standard no. 14-1 Or Two layers of No. 15 Asphalt Type 1 complying with ASTM D 226

L. Screws: Corrosion resistant, Number 8 self-tapping metal screws.

M. Joint Sealer and Accessory Materials: As specified in Section 07920.

## 2.4 SOURCE QUALITY CONTROL

A. Prepare a field mock-up representing the most common shape required on the project.

1. Manufacture the full size unit in color and texture required.
2. Notify Architect when mock-up is ready for inspection. Approved mock-up may become part of the Work.
3. Architect will inspect only for color, texture, and overall appearance complying with specified requirements.
4. Upon approval of mock-up unit, manufacture and install remaining units to match using same materials and mix design.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Do not begin installation until supporting structure has been completed; verify that substrates are plumb and true.

B. Check field dimensions and tolerances of supporting structure before beginning installation. Where dimensions and tolerances will prevent proper installation, notify Architect and wait for instructions before beginning installation.

## 3.2 PREPARATOIN

A. Environmental Conditions:

1. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry Work.
2. Cold Weather Protection: When temperature of outside air is below 40 degrees F, pre-condition materials and finish Work per the requirements set forth in ACI- 530.1, Section 1.8.
3. Hot Weather Protection: Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperature of 99 degrees F in shade with relative humidity less than 50 percent per the requirements set forth in ACI- 530.1, Section 1.8.

## 3.3 INSTALLATION

A. Moisture Barrier: Install two layers building paper over the exterior sheathing and stud construction substrates before applying the lath.

1. Overlapping a minimum of 2” on the horizontal and 6” on the vertical seams required.

B. Install metal lath to the prepared substrate.

1. Overlap minimum of 2” on the horizontal and 6” on the vertical seams required.
2. Vertical seams shall be at least 16” from a corner. The lath shall be fastened on both sides of the corner, every 6” vertically.
3. Fasten the lath using screws to the metal studs on 6 inches vertically with a minimum of 1/2 inch stud penetration.
4. Intermediate fastening to ensure continuous contact of the lath to the substrate is required.
5. Provide expansion joints in the stone to coincide with expansion joints in the mating surface or as required by architect or engineer specifications.

C. Scratch Coat

1. Install a scratch coat of mortar. Using a trowel, apply an even layer of mortar into and over the wire lath obtaining complete coverage. Work the mortar into the holes in the wire lath and scrape off the excess, make certain not to re-expose the wire lath.
2. While the mortar is still slightly wet, use a soft bristled brush to rough up the scratch coat. Virtually no mortar should be removed within the brushing process.

D. Layout coursing and corners.

1. Units shall be coursed and laid from top to bottom.

E. Set units using industry accepted mortared masonry techniques:

1. Using a trowel, apply 3/8” to ½” of mortar to the back of the stone. Make sure the entire back of the stone is covered.
2. Set the stone by pressing and moving the stone back and forth to create suction that will hold the stone in a permanent position. Once set further movement or bumping the stone may break the bond.
3. Remove excess mortar before installing adjacent stones. Keep the face of the stone clean.
4. Fill in the top of the stone with mortar.
5. Leave joints open at cornices, copings, projecting courses, and abutting dissimilar materials.
6. Provide expansion joints in the coursing to coincide with wall expansion joints in substrate.
7. Keep stone at least 6 inches above grade.

F. Mortar Grout Joints:

1. Grout units with a grout bag technique.
2. Rake top of joint and detail to create a uniform surface and solid joint.
3. Replace cracked mortar.

G. Open Joints: Install sealant backer, prime joint surfaces, and install sealant with tooled joint surface matching mortar joints to comply with Section 079200.

H. Clean stone surface after pointing mortar has set; use dry soft fiber brushes.

3.4 CLEANING AND PROTECTION

A. Protect installed units from mud, dirt, cement, paint, sealant, and other materials until completion of project; clean soiled units.

B. To clean, use fiber brushes and clean water if needed; DO NOT clean with acid or commercial cleaners unless specifically approved by manufacturer.

C. Repair or replace damaged units and units that cannot be adequately cleaned before Substantial Completion; for repair, use only mechanics and techniques approved by manufacturer.

END OF SECTION 047300

# SECTION 05 1200 - STRUCTURAL STEEL FRAMING

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

### 1.2 SECTION INCLUDES

A. Structural steel framing members.

B. Base plates.

C. Grouting under base plates.

### 1.3 RELATED REQUIREMENTS

A. Section 01 4533 - Structural Testing and Special Inspection.

B. Section 03 1510 - Post-Installed Anchors.

### 1.4 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2011.

B. AISC 360 - Specification for Steel Buildings; American Institute of Steel Construction, Inc.; 2005.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.

D. AISC S348 (Research Council on Structural Connections) - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2012.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2012.

G. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

H. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2013.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2010a.

J. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a.

K. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011.

M. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.

N. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2013.

O. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

P. ASTM F1852 - Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2002

Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

R. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

## 1.5 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Shop Drawings:

1. Review the Contract Documents prior to preparing shop drawings to determine if the structure is in conflict with OSHA requirements or any other safety regulation. Notify the Architect if any conflicts are noted. Do not prepare shop drawings affected by the conflict until the conflict is resolved.

2. Prepare complete shop and setting drawings based on referenced AISC Specifications.

3. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

4. Indicate type and location of shop and field connections. Detail all required field welds.

5. Indicate cambers.

6. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

7. If shop drawings are resubmitted after the original review, identify all changes made to the shop drawings after the original submittal with clouds or similar markings.

C. Submit AISC Quality Certification Program certificates (for reduction in shop special inspections only if the fabricator is so certified) and welder qualifications to the Special Inspector-Technical.

D. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.6 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC "Manual of Steel Construction".

B. Fabrication plant shall be certified in category I or II according to the requirements of the AISC Quality Certification Program and shall be acceptable to the structural engineer, Architect, and building official.

C. A fabricator without AISC certification may be acceptable subject to the following.

1. The fabrication plant shall be acceptable to the Structural Engineer, Architect, and Building Official.

2. The fabrication plant shall maintain written, detailed fabrication and quality control procedures that provide a basis for inspection control of the workmanship and for the fabricator's ability to conform to the construction documents.

3. The Contractor shall pay for inspection during steel fabrication. This inspection shall be conducted by the Owner's inspection company at the fabrication plant.

D. 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.

E. Codes and Standards:

1. AISC - Manual of Steel Construction.

2. AISC 360 - Specification for Structural Steel Buildings

3. AISC - Code of Standard Practice for Steel Buildings and Bridges

4. AWS D1.1.

5. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts

6. SSPC - SSPC Painting Manual - Volume 2

F. Provide personnel qualified according to AWS D1.1 for all shop and field welding.

1.7 PROJECT/SITE CONDITIONS

A. Verify all dimensions given on the Drawings and make such field measurements as are necessary to lay out the work properly and assure proper elevations. Be fully responsible for accuracy of all measurements and laying out of the work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Angles, Plates, and Channels: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B.

D. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A.

E. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, medium carbon, plain.

1. Tension control bolts meeting ASTM F1852 are also acceptable.

F. Unheaded Anchor Rods: ASTM F 1554, Grade 36, plain, with matching ASTM A 563 or A 563M nuts and ASTM F 436 Type 1 washers. Hot dip galvanize where noted.

G. Load Indicator Washers: Provide washers complying with ASTM F 959 at all connections requiring high-strength bolts. Not required if tension control bolts are used.

H. Welding Materials: AISC Specification A35 and referenced AWS specifications, type required for materials being welded, E70 electrodes.

I. Non-Shrink Grout: ASTM C 1107 Grade B; Conformance to ASTM C1107 shall occur with a minimum temperature range of 45 degrees F to 90 degrees F, a fluid consistency, and a minimum 30 minute working time. Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,400 psi (17 MPa).

2. Minimum Compressive Strength at 28 Days: 7,000 psi (48 MPa).

J. Shop and Touch-Up Primer: Fabricator's standard, compatible with finish coatings, complying with VOC limitations of authorities having jurisdiction.

K. Post-installed anchors: See Section 03 1510

## 2.2 FABRICATION

A. Fabricate according to referenced AISC publications.

B. Shop fabricate to greatest extent possible.

C. Do not substitute sections or modify details without written approval of the Structural Engineer. Provide full-length pieces between connections or splices indicated on the drawings. Do not permit built-up lengths. Do not use warped or damaged sections.

D. Design shop and field connections unless detailed on the Drawings. Use standard connections as shown in Part 9 of the AISC Manual where possible. Bolt field connections, unless otherwise indicated on the Drawings.

E. Perform bracing, blocking, cutting, fitting, drilling, tapping, welding, punching, etc., as required to complete work and to join work of others. Weld clip angles and plates to beams and punch holes for fastening work of other trades as shown on the Drawings.

F. Furnish anchor bolts of size and type shown on the drawings for all field connections to be permanently bolted to concrete or masonry.

## 2.3 FINISH

A. Prepare structural component surfaces in accordance with SSPC SP 3 unless otherwise indicated.

B. Shop prime structural steel members to a DFT of 2.0 - 3.5 mils. Do not prime surfaces that will be fireproofed or field welded.

## 2.4 SOURCE QUALITY CONTROL

A. If Fabricator is not a Category I AISC certified fabricator, see field quality control section of Part 3 for special inspection requirements of shop fabricated work.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 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. Exercise care in handling structural steel during unloading, storage, and erection to prevent bends, twists, or other damage.

D. Place structural steel stored at the site on substantial shores or blocking. Provide shores or blocking of sufficient size and strength to prevent any part of the steel from touching the ground.

E. Remove dirt, oil, loose scale, burrs, pits, paint and other defects that would prevent solid seating of parts.

F. Field weld components indicated on shop drawings.

G. Where A307 bolts are used, tighten to a snug tight fit as obtained with the full effort of a man using an ordinary spud wrench. Verify that all parts are in contact. Use self-locking nuts or upset bolt threads to prevent nuts from bracing off.

H. Where A325 bolts are used, tighten bolts and provide washers in accordance with "Specification for Structural Joints Using ASTM A325 or A490 Bolts". Use tension control bolts or direct tension indicators for slip-critical (SC) and fully tensioned bolts (FT).

I. Pre-heat material to be welded and maintain interpass temperatures as required. Do not weld below 0 degrees F.

J. Do not cut steel or enlarge holes without written approval of the Structural Engineer.

K. Do not field cut or alter structural members without approval of Architect and Structural Engineer.

L. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete or specified to be unprimed.

M. 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.

N. Repair or replace structural steel damaged during shipment, unloading, or erection at no cost to the Owner.

O. Install expansion and adhesive anchors in strict accordance with manufacturer’s recommendations.

## 3.3 CLEANING AND REPAIR

A. After erection and welding of steel, remove clay, mud or other foreign materials from all members.

B. Apply a field touch-up coat of paint on all welded connections and damaged areas using the same color and type of paint used on the shop coat.

## 3.4 FIELD QUALITY CONTROL

A. Structural Testing and Special Inspection

1. Structural Special Inspection shall be performed by qualified parties as specified herein, and in accordance with the provision of Section 01 4533.

2. If special inspection of Fabricator's work is required, special inspector may test and inspect structural steel at plant before shipment.

3. Definitions:
   a. ASNT - American Society for Non-Destructive Testing
   b. CAWI - American Welding Society Certified Associate Weld Inspector
   c. CWI - American Welding Society Certified Weld Inspector

4. Personnel Qualifications
   a. Special Inspector Technical I: CAWI or ASNT Level I, employed by a testing agency and supervised by a CWI or ASNT Level III with a minimum of 10 years experience.
   b. Special Inspector Technical II: CAWI with minimum 3 years experience or ASNT Level II, employed by a testing agency and supervised by a CWI or ASNT Level III with a minimum of 10 years experience.
   c. Special Inspector – Structural I: Graduate civil/structural engineer, or other personnel acceptable to the SER, with experience in design of structural systems of the project type. Inspections shall be performed under the direct supervision of a licensed structural engineer, as defined in Section 01 4533. The licensed engineer shall review and approve all inspection reports.
   d. Individuals performing welding inspection must be AWS certified.

5. The Owner will provide the following tests and inspections:
   a. Perform tests and inspections required below. Bolt and welding inspections for shop fabricated work may be reduced or deleted if fabrication shop satisfies AISC Quality Certification Program - Category I, or more stringent criteria. Any reduction in tests or inspections is subject to approval of Building Official and SER.
   b. Test high strength bolted connections according to the requirements of RCSC "Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts", and as follows:
      1) Preparation: Visually inspect mating surfaces and bolt type for all bolted connections for general conformance with the contract documents prior to bolting. Qualifications: Technical II.

2) Slip Critical Bolts and Fully Tensioned Bolts: Visually observe all connections. Verify that all plies of connected elements have been brought into contact. Verify all tips are removed from "twist-off" bolts or direct tension indicators show fully tensioned bolts. Qualifications: Technical II.
3) Bearing Bolts: Visually observe all connections to confirm all plies of connected elements have been brought into contact. (Applies only to bolts designed with threads included in failure plane; all other bolts require testing as for fully tensioned bolts.) Qualifications: Technical II.

c. Welding Procedures and Preparation: Qualifications: Technical II. Verify the following:
1) Qualifications of all welders as AWS certified.
2) Proposed welding procedures and materials.
3) Adequate preparation of fraying surfaces.
4) Preheat and interpass temperatures of steel, proper technique and sequence of welding, and cleaning and number of passes.

d. Test and inspect welding as follows
1) Fillet Welds: Visually inspect 100% of all fillet welds, for size, length, and quality, per AWS D1.1. Qualifications: Technical II.
2) Partial Penetration Welds: Test 100% of all partial penetration welds exceeding 5/16 inch, using Ultrasonic Testing per AWS D1.1, Section 6. Visually inspect 100 % and test 25% of all penetration welds less than 5/16 inch using Magnetic Particle Testing per ASTM E 709 performed on root pass and on finished weld. Qualifications: Technical II.
3) Full Penetration Welds: Test 100% of all full penetration welds exceeding 5/16 inch, using Ultrasonic Testing per AWS D1.1 Section 6. Visually inspect 100% and test 25% of all full penetration welds less that 5/16 inch, using Magnetic Particle Testing per ASTM E 709 performed on root pass and on finished weld. Qualifications: Technical II.

e. Submittals: Verify mill test reports and other submitted documentation for compliance with contract documents. Qualifications: Structural I

f. Materials: Verify materials delivered to site comply with contract documents and approved shop drawings. Qualifications: Technical I

g. Detail Compatibility: On a periodic basis, inspect the following to verify member orientation, configuration, type, and size comply with details indicated on the contract documents and shop drawings. Qualifications: Structural I.
1) Permanent bracing and stiffening members.
2) Proper applications of joint details and conditions. Observations need not exceed 25% at standard connections.
3) Other work critical to the integrity of the building structure.

END OF SECTION

# SECTION 055000 - METAL FABRICATIONS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Picture shelf.
5. Miscellaneous steel trim.
6. Loose bearing and leveling plates.
7. Patio fence brackets and supporting structure.
8. Functional rack metal components.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete.

### 1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

### 1.3 SUBMITTALS

A. Product Data: For the following:
1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

### 2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

### 2.3 NONFERROUS METALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

### 2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

### 2.5 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

## 2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches (600 mm) o.c.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

## 2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.9 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Custom Fabricate Steel or Prefabricated Aluminum Ladders:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alco-Lite Industrial Products.
b. O'Keeffe's Inc.
c. Precision Ladders, LLC.

2. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
3. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
4. Rungs: Extruded-aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.

## 2.10 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

## 2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

## 2.12 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Galvanize loose steel lintels located in exterior walls.

C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

## 2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

## 2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

## 2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

## 3.2 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

C. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

## 3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

# SECTION 055213 - PIPE AND TUBE RAILINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Steel pipe handrails.

### 1.2 PERFORMANCE REQUIREMENTS

1. Handrails:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

### 1.3 SUBMITTALS

A. Product Data: For the following:

1. Manufacturer’s product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but at not limited to, the following:

1. Steel Pipe and Tube Railings:

a. Pisor Industries, Inc.
b. Sharpe Products.
c. Wagner, R & B, Inc.; a division of the Wagner Companies.

## 2.2 METALS, GENEARL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

B. Steel and Iron:

1. Tubing: ASTM A 500 (cold formed).
2. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
3. Plates, Shapes, and Bars: ASTM A 36/A 36M.
4. Cast Iron: Either gray iron, ASTMA A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
5. Expanded Metal: ASTM F 1267, Type I (expanded), Class 1 (uncoated).

## 2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

D. Shop Primers: Provide primers that comply with Division 09 painting Sections.

E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.4 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. General: Fabricate railings to comply with design, dimensions, and details indicated, but not less than that required to support structural loads.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

D. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings.

E. Form changes in direction by bending or by inserting prefabricated elbow fittings.

F. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.

G. Form changes in direction by bending or by inserting prefabricated elbow fittings.Close exposed ends of railing members with prefabricated end fittings.

H. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.

I. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

2.5 FINISHES

A. Steel and Iron:

1. Shop-Primed Galvanized Railings: After galvanizing, clean railings, treat with metallic-phosphate process, and apply primer to comply with SSPC-PA 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

B. Attach railings to wall with wall brackets, except where end flanges are used. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt predrilled hole for exposed bolt anchorage.

C. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.2 Adjusting and Cleaning:

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055213

# SECTION 06 1000 - ROUGH CARPENTRY

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

### 1.2 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Sheathing.

C. Subflooring.

D. Preservative treated wood materials.

E. Miscellaneous framing and sheathing.

F. Concealed wood blocking, nailers, and supports.

### 1.3 RELATED REQUIREMENTS

A. Section 03 1510 - Post-Installed Anchors.

B. Section 06 1753 - Shop-Fabricated Wood Trusses.

### 1.4 REFERENCE STANDARDS

A. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2012.

B. ANSI/ASME Standard B18.2.1 - Square and Hex Bolts and Screws (Inch Series); 1981

C. ANSI/ASME Standard B18.6.1 - Wood Screws (Inch Series); 1981

D. APA - The Engineered Wood Association, (APA-PRR-401), Performance Standard for APA EWS Rim Boards; 2002.

E. APA - The Engineered Wood Association, (APA-PRL-501), Performance Standard for APA EWS Laminated Veneer Lumber; 2000.

F. ASTM A123-02 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength; 2002

I. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems; 2003

J. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes and Staples; 2003

K. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2012.

L. PS 2 - Performance Standard for Wood-Based Structural-Use Panels; National Institute of Standards and Technology, U.S. Department of Commerce; 2010.

M. PS 2 - Wood-Based Structural Use Panels; National Institute of Standards and Technology (Department of Commerce);; 2004

N. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology, Department of Commerce; 2010.

## 1.5 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Product Data: Provide technical data on metal framing connectors, power-driven fasteners, rim boards, and laminated veneer lumber.

## 1.6 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

## 2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. Species as indicated below for each use.

2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (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.

## 2.2 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing ( 2x4 and 2x6) used in a vertical position in bearing walls:

1. Species: Spruce-Pine-Fir.

2. Grade: No. 2.

D. Joist and Small Beam Framing (2x6 through 4x16 ):

1. Species: Hem-Fir.

2. Grade: No. 2.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.

2. Boards: Standard or No. 3.

## 2.3 ENGINEERED WOOD PRODUCTS

A. Laminated Veneer Lumber (LVL): APA PRL-501, Stress Class 1.9E-2600F. Parallel Strand Lumber (PSL) with matching or better properties may be substituted.

1. Acceptable manufacturers include Weyerhauser, Boise Cascade, Louisiana-Pacific, Georgia-Pacific, Willamette Industries, and RedBuilt.

2. Minimum design properties:
   a. Bending = 2,600 psi
   b. Horizontal shear perpendicular to glue line = 285 psi
   c. Compression parallel to grain = 2,510 psi
   d. Compression perpendicular to grain parallel to glue line = 750 psi
   e. Modulus of elasticity = 1,900,000 psi
   f. Tension parallel to grain = 1,555 psi

B. Rim Board: APA PRR-401, Rim Board, 1" minimum thickness, or, Rim Board Plus, 1-1/8" minimum thickness.

## 2.4 TIMBERS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry (19 percent maximum).

C. Beams and Posts 5 inches (125 mm) and over in thickness:

1. Species: Douglas Fir-Larch.

2. Grade: No. 1.

## 2.5 CONSTRUCTION PANELS

A. Subflooring: Any PS 2 type, rated Sheathing.

1. Bond Classification: Exterior.

2. Span Rating: 48.

3. Performance Category: 3/4 PERF CAT.

4. Edges: square or tongue and groove. Square edge may be used if underlayment is used.

B. Roof Sheathing: PS-2; APA Rated Sheathing.

1. Exposure Class: Exterior.

2. Span Rating: 24/16 (610/406).

3. Thickness: 1/2 inch (13 mm), nominal.

4. Edges: Tongue and groove.

C. Wall Sheathing: PS-2; APA Rated Sheathing.

1. Exposure Class: Exterior.

2. Span Rating: 16/0 or wall-16oc.

3. Thickness: 1/2 inch (13 mm), nominal.

4. Edges: Square.

## 2.6 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M or stainless steel for high humidity and preservative-treated wood locations and to match finish on metal connectors, unfinished steel elsewhere.

2. Nails: ASTM F1667, common wire nails, unless otherwise specified.

3. Bolts: ASTM A307.

4. Lag Screws: ANSI/ASME Standard B18.2.1

5. Wood Screws: ANSI/ASME Standard B18.6.1.

B. Post-installed anchors and power driven fasteners: See Section 03 1510

C. Metal Framing Connectors: Includes hangers, post bases, post caps, tension ties, hold-downs, and framing angles. Hot dipped galvanized steel, sized to suit framing conditions.

1. Drawings show Simpson Strong-Tie products. Alternate products shall have equal or greater strength.

2. All products to have current ICC approval.

3. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing per ASTM A 653/A 653M, hot-dipped galvanizing per ASTM A123, or stainless steel, grade 316L.

D. Sill Gasket on Top of Foundation Wall: 1/4 inch (6 mm) thick, plate width, closed cell plastic foam from continuous rolls.

E. Sill Flashing: As specified in Division 07..

F. Subfloor Glue: ASTM D3498, APA AFG-01, waterproof, water base, air cure type, cartridge dispensed.

## 2.7 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 Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.

1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

2. Treat lumber exposed to weather.

3. Treat lumber in contact with roofing, flashing, or waterproofing.

4. Treat lumber in contact with masonry or concrete.

5. Treat lumber less than 18 inches (450 mm) above grade.

6. Treat lumber in other locations as indicated.

7. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
   a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
   b. Treat plywood in contact with roofing, flashing, or waterproofing.
   c. Treat plywood in contact with masonry or concrete.
   d. Treat plywood less than 18 inches (450 mm) above grade.
   e. Treat plywood in other locations as indicated.

## 2.8 SOURCE QUALITY CONTROL

A. Provide dimension lumber with each piece factory marked with grade stamp of an accredited grading agency identifying grade, species, and moisture content at time of surfacing.

B. Provide APA-rated panels with each piece factory marked with grade stamp of APA identifying type, exposure durability classification, span rating, and thickness.

C. Provide APA-rated rim boards and LVL with APA EWS trademark.

# PART 3 EXECUTION

## 3.1 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 (100 mm) and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

## 3.2 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.

## 3.3 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by AFPA Wood Frame Construction Manual and IBC Table 2304.9.1.

E. Strictly comply with manufacturer's installation instructions for product installation. Install all bolts and nails in metal framing connectors.

F. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches (38 mm) of bearing at each end.

G. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

H. Provide bridging at joists in excess of 8 feet (2.3 m) span at mid-span. Fit solid blocking at ends of members.

I. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

## 3.4 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

## 3.5 INSTALLATION OF CONSTRUCTION PANELS

A. General

1. Install sheathing with panel continuous over two or more spans.

2. Provide 1/8" space at ends and edges of panels unless otherwise indicated by the panel supplier.

3. Apply adhesives in strict accordance with manufacturer's instructions. Apply continuous glue line on joists and a spaced glue line in groove of tongue and groove panels.

B. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.

1. At long edges provide solid edge blocking where joints occur between roof framing members.

2. Nail panels to framing; staples are not permitted.

C. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails or screws.

## 3.6 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from true position, maximum.

B. Surface Flatness of Floor: 1/4 inch in 10 feet (2 mm/m) maximum, and 1/2 inch in 30 feet (14 mm in 10 m) maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

## 3.7 CLEANING

A. After erection and attachment of lumber, remove clay, mud, or other foreign materials from all members.

B. Waste Disposal: Comply with the requirements of Section 01 7419.

1. Comply with applicable regulations.

2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.

4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

C. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

D. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

# SECTION 061600 - SHEATHING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Subflooring.
4. Sheathing joint and penetration treatment.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements.

### 1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:

1. Preservative-treated plywood.
2. Fire-retardant-treated plywood.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

### 2.2 WOOD PANEL PRODUCTS

A. Plywood: DOC PS 1.

## 2.3 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction, Use Category UC3b for exterior construction.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

## 2.4 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat plywood indicated on Drawings.

## 2.5 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.

## 2.6 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing.

2.7 SUBFLOORING AND UNDERLAYMENT

A. Plywood Subflooring: Exterior, Structural I single-floor panels or sheathing.

2.8 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M

2.9 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Subflooring:

a. Glue and nail to wood framing.
b. Space panels 1/8 inch (3 mm) apart at edges and ends.

2. Wall and Roof Sheathing:

a. Nail to wood framing.
b. Space panels 1/8 inch (3 mm) apart at edges and ends.

END OF SECTION 061600

# SECTION 06 1753 - SHOP-FABRICATED WOOD TRUSSES

## PART 1 GENERAL

### 1.1 CONTRACT CONDITIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division - 1 Specification Sections, apply to this Section.

### 1.2 SECTION INCLUDES

A. Shop fabricated wood trusses for roof and floor framing.

B. Bridging, bracing, and anchorage.

### 1.3 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Installation requirements for miscellaneous framing.

### 1.4 REFERENCE STANDARDS

A. AFPA - National Design Specification for Wood Construction (NDS); 2005 Edition.

B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2011.

D. IBC - International Building Code; International Code Council; 2012.

E. TPI BCSI 1 - Building Component Safety Information Booklet: The Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses; joint publication of the Truss Plate Institute and the Wood Truss Council of America; 2011.

F. TPI DSB-89 - Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses; Truss Plate Institute; 1989.

### 1.5 DESIGN REQUIREMENTS

A. Comply with applicable code for structural loading criteria None - N/A.

B. Design for superimposed dead, live/snow, wind, and seismic loads shown on drawings.

C. Deflection Limitations

1. Roof and floor dead load deflection limited to 1/240 of span.

2. Floor live load deflection limited to 1/480 of span.

3. Roof live load deflection limited to 1/360 of span.

## 1.6 SUBMITTALS

A. See Division 1 for submittal procedures.

B. Certification: Provide certification that truss fabricator meets quality assurance requirements of this section.

C. Product Data: Manufacturer's data sheets on plate connectors, manufactured bracing components, truss hangers, and manufactured anchorage connectors.

D. Shop Drawings: Include individual truss design drawings for each truss, truss index/cover sheet, if used, the project truss placement diagram, and truss member permanent bracing specification.

1. Truss Design Drawings: Certified. Include the following information:
   a. Truss slope or depth, span, and spacing; location of joints; required bearing widths.
   b. Design loads including: Top chord live load (including any snow load), top chord dead load, bottom chord live load, bottom chord dead load, concentrated loads and their point of application, and controlling wind and earthquake loads.
   c. Maximum axial tension and compression forces in each member.
   d. Maximum horizontal and vertical reactions for live and dead load and corresponding deflection ratio.
   e. Each reaction force and direction.
   f. Lumber size, species, and grade for each member including any adjustments to design values for conditions of use.
   g. Metal connector plate type, size, thickness, and dimensioned location except those plates placed symmetrically on joint face. Include any adjustments to design values for conditions of use.
   h. Connection requirements for: truss hangers on supporting beams, truss to truss, truss ply to truss ply, and field splices.
   i. Permanent individual truss member bracing requirements and method of bracing as outlined in the truss member permanent bracing specification.

2. Truss Index/Cover Sheet: Certified. May be used in lieu of certifying each individual truss design drawing.

3. Project Truss Placement Diagram: Include proposed, dimensioned location of each individually designated truss and reference to the corresponding truss design drawing.

4. Truss Member Permanent Bracing Specification: Include individual truss member buckling reinforcement or permanent bracing details to transmit individual truss member buckling loads to the floor/roof diaphragm. Individual truss member buckling

reinforcement can be shown on the truss design drawings or on supplemental truss member buckling reinforcement diagrams.

a. In lieu of the above, provide a certified specific truss member permanent bracing plan and associated details for each floor/roof system.

## 1.7 QUALITY ASSURANCE

A. Truss Design, Fabrication, and Installation: In accordance with TPI 1, TPI DSB-89, AFPA NDS, and IBC.

B. Fabricator Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience. Licensee of the Truss Plate Institute Quality Assurance Program, or an ICC-approved fabricator.

C. Designer Qualifications: Perform design by or under direct supervision of a Professional Engineer experienced in design of this Work and licensed in the State in which the Project is located.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Handle and store prefabricated wood members in accordance with manufacturer's instructions. Avoid loads due to bending, overturning, or other cause for which member is not designed to resist or endure.

B. Handle and erect trusses in accordance with TPI BCSI 1.

C. Store trusses in vertical position resting on bearing ends. Do not lay trusses flat.

D. Store materials in dry, well-ventilated areas free of extremely high or low temperatures and humidities, and extreme variations in temperature and humidity.

E. Protect all material from damage due to moisture, weather, and construction work.

## 1.9 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated.

# PART 2 PRODUCTS

## 2.1 MATERIALS

A. Lumber:

1. Species: Douglas Fir-Larch, Hem-Fir, Spruce-Pine-Fir, Southern Pine, or other species, at fabricator's discretion, as needed for specified loadings. Grade as required for specified loadings.

2. Moisture Content: Between 7 and 19 percent.

3. Lumber fabricated from old growth timber is not permitted.

B. Steel Connectors: Hot-dipped galvanized steel sheet, ASTM A653/A653M Structural Steel (SS) Grade 33/230, with G60/Z180 coating; die stamped with integral teeth; thickness as required.

C. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

## 2.2 ACCESSORIES

A. Wood Blocking, Bridging, Plates, and Miscellaneous Framing: As specified in Section 06 1000.

B. Fasteners: Electrogalvanized steel, type to suit application.

C. Metal Framing Connectors

1. Truss hangers, tension ties, and hold-downs to support the service loads specified and developed by truss designer.

2. Acceptable manufacturers: Simpson Strong-Tie, USP Lumber Connectors, or approved equal.

3. Galvanize metal framing connectors exposed to moisture in accordance with ASTM A153.

4. Provide fasteners needed per manufacturer's recommendations for complete installation of all connectors.

## 2.3 FABRICATION

A. Fabricate trusses to achieve structural requirements specified.

B. Fabricate metal plate connected wood trusses as required by the TPI Quality Assurance Plan.

1. Cut members accurately to provide close fitting joints with proper wood-to-wood bearing in assembled unit.

2. Fabricate and locate metal connector plates to meet requirements of truss design.

3. Fasten connector plates to both sides of wood members according to industry standard practice.

4. Indicate required location of bridging or secondary bracing with a tag. Show requirements on tag.

C. Brace wood trusses in accordance with TPI DSB-89 and BCSI 1.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Verify that supports and openings are ready to receive trusses and do not have defects that will affect erection or quality of workmanship. Do not erect members until unsatisfactory conditions have been corrected.

### 3.2 ERECTION

A. Install trusses in accordance with manufacturer's instructions and TPI DSB-89 and TPI BCSI 1; maintain a copy of each TPI document on site until installation is complete.

B. Hoist units at lift points recommended by the fabricator exercising care not to damage truss members or joints by out-of-plane bending or other causes.

C. Set members level and plumb, in correct position.

D. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in true alignment until completion of erection and installation of permanent bracing.

E. Do not field cut or alter structural members without approval of Architect.

F. Install permanent bridging and bracing to withstand dead, live, and lateral loads and to comply with design and manufacturer's requirements.

G. Install headers and supports to frame openings required.

H. Frame openings between trusses with lumber in accordance with Section 06 1000.

I. Provide special framing as shown on drawings or shop drawings for eaves, overhangs, dormers, and similar conditions, if any

J. Coordinate placement of decking with work of this section.

### 3.3 TOLERANCES

A. Framing Members: 1/2 inch (12 mm) maximum, from true position.

### 3.4 CLEANING

A. After erection and attachment of prefabricated structural wood, remove clay, mud, or other foreign materials from all members.

END OF SECTION

# SECTION 062023 - INTERIOR FINISH CARPENTRY

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Shelving and clothes rods.

B. See Division 06 Section "Interior Architectural Woodwork" for interior woodwork not specified in this Section.

### 1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by ALSC's Board of Review.

### 2.2 FIRE-RETARDANT-TREATED MATERIALS

A. Lumber: Comply with performance requirements in AWPA C20, Interior Type A. Kiln dry after treatment to a maximum moisture content of 19 percent.

### 2.3 STANDING AND RUNNING TRIM

A. Hardwood Lumber Trim:

1. Species and Grade: As noted on finish schedule.
2. Maximum Moisture Content: 9 percent.

### 2.4 MISCELLANEOUS MATERIALS

A. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue.

1. Use wood glue that has a VOC content of 30 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.2 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work.
2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset.

3.3 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Cope at returns and miter at corners to produce tight-fitting joints. Use scarf joints for end-to-end joints.

END OF SECTION 062023

# SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Interior standing and running trim.
2. Flush plastic laminate paneling.
3. Wood cabinets.
4. Plastic-laminate cabinets.
5. Plastic-laminate countertops.
6. Solid-surfacing-material countertops.
7. Shop finishing of woodwork.

B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.

C. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stair work are specified in Division 06 Section "Rough Carpentry."

### 1.2 SUBMITTALS

A. Product Data: For solid-surfacing material, cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
2. Plastic-laminates, for each type, color, pattern, and surface finish.
3. Solid-surfacing materials.

D. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

### 1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of woodwork.

B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" most recent edition.

1. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.

## 1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Wood Species and Cut for Transparent Finish: See Finish Specifications in drawings.

B. Wood Products:

1. Hardboard: AHA A135.4.
2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

D. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.

1. Manufacturers: Subject to compliance with requirements. See finish specifications in drawings.

## 2.2 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use Exterior Type or Interior Type A. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Kiln-dry material after treatment.

B. Fire-Retardant Particleboard: Panels made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.

C. Fire-Retardant Fiberboard: ANSI A208.2 medium-density fiberboard panels made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture with flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

## 2.3 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural woodwork, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Pulls: See millwork details.

E. Catches: Magnetic catches, BHMA A156.9, B03141

F. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
2. Box Drawer Slides: Grade 1; for drawers not more than 6 inches (150 mm) high and 24 inches (600 mm) wide.
3. File Drawer Slides: Grade 1HD-100; for drawers more than 6 inches (150 mm) high or 24 inches (600 mm) wide.
4. Pencil Drawer Slides: Grade 2; for drawers not more than 3 inches (75 mm) high and 24 inches (600 mm) wide.

G. Aluminum Slides for Sliding Glass Doors: BHMA A156.9, B07063.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Brushed stainless steel. (US32D) unless noted otherwise in drawings.

## 2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

## 2.5 FABRICATION

A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.

1. Interior Woodwork Grade: Premium.

2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
3. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

B. Interior Standing and Running Trim:

1. For transparent-finished trim items wider than available lumber, use veneered construction. Do not glue for width.
2. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
3. Assemble casings in plant except where limitations of access to place of installation require field assembly.

C. Fire-Rated Interior Frames and Jambs: Products fabricated from fire-retardant particleboard with veneered, exposed surfaces and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Fire Rating: As noted in drawings or required by state building code and authorities having jurisdiction.

D. Wood Cabinets for Transparent Finish:

1. AWI Type of Cabinet Construction: As indicated on drawings.

E. Plastic-Laminate Cabinets:

1. AWI Type of Cabinet Construction: As indicated on drawings.
2. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate as follows:

   a. Horizontal Surfaces Other Than Tops: Grade HGS.
   b. Postformed Surfaces: Grade HGP.
   c. Vertical Surfaces: Grade HGS or VGS.
   d. Edges: Grade HGS orGrade VGS .

3. Materials for Semiexposed Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
4. Drawer Sides and Backs: Thermoset decorative panels.
5. Drawer Bottoms: Thermoset decorative panels.
6. Colors, Patterns, and Finishes: See finish specifications in drawings.
7. Provide dust panels of 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers, unless located directly under tops.
8. Do not use Thermostat products in food service areas unless approved by authorities having jurisdiction.

F. Plastic-Laminate Countertops:

1. High-Pressure Decorative Laminate Grade: HGS.
2. Colors, Patterns, and Finishes: See finish specifications in drawings.

3. Edge Treatment: Same as laminate cladding on horizontal surfaces.
4. Core Material at Sinks: Medium-density fiberboard made with exterior glue.

G. Solid-Surfacing-Material Countertops:

1. Solid-Surfacing-Material Thickness: 1.18 inch (3 cm).
2. Colors, Patterns, and Finishes: See finish specifications in drawings.
3. Fabricate tops in one piece with loose backsplashes for field application. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

## 2.6 SHOP FINISHING

A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.

C. Transparent Finish:

1. Grade: Premium.
2. AWI Finish System: TR-4 conversion varnish and TR-6 catalyzed poly-urethane on horizontal tops and surfaces exposed to moisture.
3. Staining: Match approved sample for color.
4. Wash Coat for Stained Finish: Apply a wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
5. Open-Grain Woods: After staining (if any, apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
6. Sheen: Match approved sample.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Shim as required with concealed shims.

D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Scarf running joints and stagger in adjacent and related members. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.

G. Paneling: Anchor paneling to supporting substrate with concealed panel-hanger clips or splined connection strips. Do not use face fastening, unless covered by trim.

H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

1. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.

I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."

END OF SECTION 064023

# SECTION 066400 - PLASTIC PANELING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes glass-fiber reinforced plastic (FRP) wall paneling and trim accessories.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For plastic paneling and trim accessories.

### 1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

## PART 2 - PRODUCTS

### 2.1 PLASTIC SHEET PANELING

A. General: Gelcoat-finished, glass-fiber reinforced plastic panels complying with ASTM D 5319.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Kemlite Company Inc.
b. Marlite.

2. Nominal Thickness: Not less than 0.09 inch (2.3 mm).
3. Surface Finish: Molded pebble texture.
4. Color: As noted on finish plan or as selected by Architect from manufacturer’s full range.

2.2 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color: As selected by Architect from manufacturer's full range.

B. Adhesive: As recommended by plastic paneling manufacturer.

1. VOC Content: 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Sealant: Single-component, mildew-resistant, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section "Joint Sealants."

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that could impair bond of adhesive, including oil, grease, dirt, and dust.

B. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

C. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

3.2 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive.

D. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

# SECTION 071113 - BITUMINOUS DAMP PROOFING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Cold-applied, cut-back asphalt dampproofing.
2. Cold-applied, emulsified-asphalt dampproofing.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

### 1.3 PROJECT CONDITIONS

A. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

## PART 2 - PRODUCTS

### 2.1 COLD-APPLIED, EMULSIFIED-ASPHALT DAMP PROOFING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Degussa Building Systems; Sonneborn Brand Products.
2. Gardner Gibson, Inc.
3. Henry Company.
4. Karnak Corporation.
5. Meadows, W. R., Inc.
6. Tamms Industries, Inc.

B. Trowel Coats: ASTM D 1227, Type II, Class 1.

C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

E. VOC Content: Zero.

2.2 PROTECTION COURSE

A. Protection Course, Asphalt-Board Type: ASTM D 6506, premolded, 1/8-inch- (3-mm-) thick, multi-ply, semirigid board consisting of a mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, and faced on 1 side with polyethylene film.

2.3 MISCELLANEOUS MATERIALS

A. Cut-Back Asphalt Primer: ASTM D 41.

B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

C. Asphalt-Coated Glass Fabric: ASTM D 1668, Type I.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.2 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

B. Apply dampproofing to footings and foundation walls where opposite side of wall faces building interior

1. Apply from finished-grade line to top of footing, extend over top of footing, and down a minimum of 6 inches (150 mm) over outside face of footing.
2. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
3. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where shown as "reinforced," by embedding an 8-inch- (200-mm-) wide strip of asphalt-coated glass fabric in a heavy coat of dampproofing. Dampproofing coat for embedding fabric is in addition to other coats required.

C. Apply dampproofing to provide continuous plane of protection on exterior face of inner wythe of exterior masonry cavity walls.

3.3 COLD-APPLIED, EMULSIFIED-ASPHALT DAMP PROOFING

A. On Unparged Masonry Foundation Walls: Apply primer and 1 trowel coat at not less than 5 gal./100 sq. ft. (2 L/sq. m).

B. On Unexposed Face of Masonry Retaining Walls: Apply primer and 1 brush or spray coat at not less than 1.25 gal./100 sq. ft. (0.5 L/sq. m).

## 3.4 INSTALLATION OF PROTECTION COURSE

A. Where indicated, install protection course over completed-and-cured dampproofing. Comply with dampproofing material manufacturer's written recommendations for attaching protection course.

1. Support protection course with spot application of adhesive of type recommended by protection board manufacturer over cured coating.
2. Install protection course on same day within 24 hours of installation of dampproofing (while coating is tacky) to ensure adhesion.

END OF SECTION 071113

# SECTION 071900 - WATER REPELLENTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. Cast-in-place concrete.
2. Precast concrete.
3. Cast stone.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product certificates.

### 1.3 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

## PART 2 - PRODUCTS

### 2.1 PENETRATING WATER REPELLENTS

A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOCs.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. OKON Co., Inc., Division of ZINSSER Co., Inc., an RPM company; S-40.
   b. PROSOCO, Inc.; Siloxane WB Concentrate.
   c. Tamms Industries, Inc., Euclid Chemical Company (The); Chemstop WB Heavy Duty.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in representative locations by method recommended by manufacturer.
2. Inspect for previously applied treatments that may inhibit penetration or performance of water repellents.
3. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
4. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

## 3.2 PREPARATION

A. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.

B. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

C. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

## 3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a heavy-saturation coating of water repellent, on surfaces indicated for treatment, using low-pressure spray to the point of saturation. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

## 3.4 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

# SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Spray polyurethane foam insulation.
4. Vapor retarders.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product test reports.

C. Research/evaluation reports.

## PART 2 - PRODUCTS

### 2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DiversiFoam Products.
   b. Dow Chemical Company (The).
   c. Owens Corning.

### 2.2 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Johns Manville.
3. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

## 2.3 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dow Chemical Company (The).
   b. Henry Company.
   c. Tiger Foam.

2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

## 2.4 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils (0.15 mm) thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

# PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

## 3.2 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units according to manufacturer's written instructions.

B. On horizontal surfaces under slabs, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

## 3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets according to ASTM C.

C. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

## 3.4 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.

2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

## 3.5 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.

## 3.6 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) o.c.
2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION 072100

# SECTION 072400 - EIFS (EXTERIOR INSULATION AND FINISH SYSTEMS)

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Comply with EIFS industry members associations (EIMA) “Guideline Specification for exterior insulation and finish systems (EIFS) class PS” with impact classification “Standard Resistance” (25-49 Inch-Lbs).

B. Prevent the accumulation of water behind the EIF system, either by condensation or leakage through the construction, in the design and detailing of the assembly.

C. Where a fire-resistance rating is required by code use EIFS over rated assembly comply with NFPA 268 standard.

D. Design for wind load in conformance with code requirements.

E. Provide ultra-highimpact resistance to a minimum height of 6’-0” (1.8 m) above finished grade at all areas accessible to pedestrian traffic and other areas exposed to abnormal stress or impact.

### 1.2 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer’s data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Submit Manufacturer’s drawings detailing the approved methods for flashing and waterproofing all conditions applicable to the work listed in this section.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer’s full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS

A. Substrate: Provide glass faced gypsum board unless noted otherwise on drainings. Provide manufacturer approved reinforcing mesh at substrate joints.

B. Provide base coat and reinforcing mesh and finish coat as per manufacture's written instructions.

1. Finish: As noted on exterior building elevation drawings.
2. Color: As noted on exterior building elevation drawings.

C. Provide expansion joints at all building expansion joints, at inside corners of building or where significant structural movement occurs, at substrate expansion joints, at EIFS where abuts dissimilar materials, at elevations as indicated on drawings.

D. Provide manufacturer approved coatings on surfaces to receive sealant at expansion joints and penetrations.

E. All sealants shall be compatible with manufacturer's finish.

F. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Dryvit, Outsulation system.
2. Parex, Premium system.
3. Sto, Stotherm essence system.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify that the substrate is:

1. Acceptable for use in conjunction with the work listed in this section.
2. Flat within 6.4 mm (1/4 in) in a 1.2 m (4 ft) radius.
3. Sound and dry with tight connections, no surface voids, projections, or other conditions that may interfere with the system installation or performance.

C. Install all flashings and other waterproofing details prior to commencing work.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

A. Protect adjoining work and property during installation.

B. Remove foreign materials from all substrates, such as oil, dust, dirt, form-release agents, efflorescence, paint, wax, water repellants, moisture, frost, and any other condition that may inhibit adhesion.

## 3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Apply base coat sufficiently to fully embed the mesh. The recommended method is to apply the base coat in two (2) passes.

C. Coat system surfaces in contact with textured finishes with color primer.

D. Protect materials from inclement weather and other sources of damage until completely dry.

## 3.4 CLEANING

A. All excess materials shall be removed from the job site in accordance with contract provisions and as required by applicable law.

B. Clean debris and foreign substances resulting from the contractor's work from all surrounding areas.

## 3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 072400

# SECTION 072500 - WEATHER BARRIERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Building paper.
2. Building wrap.
3. Flexible flashing.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

### 1.3 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

## PART 2 - PRODUCTS

### 2.1 WATER-RESISTIVE BARRIER

A. Building Paper: ASTM D 226, Type 1 (No. 15 asphalt-saturated organic felt), unperforated.

B. Building Paper: Water-vapor-permeable, asphalt-saturated kraft building paper.

1. Water vapor transmission not less than 35 g/sq. m x 24 hr per ASTM D 779.
2. Water resistance not less than 20 minutes per ASTM F 1249.

C. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide the following:
   a. DuPont (E. I. du Pont de Nemours and Company); Tyvek Commercial Wrap or StuccoWrap as recommended by exterior wall finish manufacturer.

2. Water-Vapor Permeance: Not less than 50 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).

D. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

2.2 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Self-adhesive butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Vycor Butyl Self Adhered Flashing.
   b. Protecto Wrap Company; BT-25 XL.
   c. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.

PART 3 - EXECUTION

3.1 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.

B. Building Paper: Apply horizontally with a 2-inch (50-mm) overlap and a 6-inch (150-mm) end lap; fasten to sheathing with galvanized staples or roofing nails.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.
2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.

1. Lap seams and junctures with other materials at least 4 inches (100 mm) except that at flashing flanges of other construction, laps need not exceed flange width.
2. Lap flashing over water-resistive barrier at bottom and sides of openings.
3. Lap water-resistive barrier over flashing at heads of openings.

END OF SECTION 072500

# SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Fluid-applied membrane air barrier, vapor retarding.

### 1.2 PERFORMANCE REQUIREMENTS

A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated

B. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counter flashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.

1. Include details of interfaces with other materials that form part of air barrier.

C. Product certificates.

D. Qualification data.

E. Product test reports.

### 1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Mockups: Before beginning installation of air barrier, build mockups of exterior wall assembly , 150 sq. ft. (14 sq. m), incorporating backup wall construction, external cladding, window, door frame and sill, insulation, and flashing to demonstrate surface preparation, crack and joint treatment, and sealing of gaps, terminations, and penetrations of air barrier membrane.

1. Coordinate construction of mockup to permit inspection by Owner's testing agency of air barrier before external insulation and cladding is installed.

2. Include junction with roofing membrane, building corner condition and foundation wall intersection and window openings.

C. Preinstallation Conference: Conduct conference at Project site.

## PART 2 - PRODUCTS

### 2.1 FLUID-APPLIED MEMBRANE AIR BARRIER

A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: synthetic polymer membrane.
1. Products: Subject to compliance with requirements, provide one of the following:

a. Synthetic Polymer Membrane:

1) Grace, W. R. & Co.; Perm-A-Barrier Liquid.
2) Henry Company; Air-Bloc 21 or 21S.
3) Prosoco R. Guard Spray Wrap.

### 2.2 AUXILIARY MATERIALS

A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by manufacturer of air barrier material.

C. Butyl Strip: Vapor-retarding, 30- to 40-mil- (0.76- to 1.0-mm-) thick, self-adhering; polyethylene-film-reinforced top surface laminated to layer of butyl adhesive with release liner backing.

D. Modified Bituminous Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.

E. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.

F. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.

G. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft (24 to 32 kg/cu. m) density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.

H. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- (1.0-mm-) thick, smooth-surfaced, self-adhering; consisting of 36 mils (0.9 mm) of rubberized asphalt laminated to a 4-mil- (0.1-mm-) thick polyethylene film with release liner backing.

I. Adhesive-Coated Transition Strip: Vapor-permeable, 17-mil- (0.43-mm-) thick, self-adhering strip consisting of an adhesive coating over a permeable laminate with a permeance of 37 perms (2145 ng/Pa x s x sq. m).

J. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil- (1.3- to 1.6-mm-) thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners.

K. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 07 Section "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 JOINT TREATMENT

A. Concrete and Masonry: Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 1193 and air barrier manufacturer's written instructions.

### 3.2 TRANSITION STRIP INSTALLATION

A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.

B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air barrier, concrete below-grade structures, floor-to floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

D. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Wall Openings: Prime concealed perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply elastomeric flashing sheet so that a minimum of 3 inches (75

mm) of coverage is achieved over both substrates. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames with not less than 1 inch (25 mm) of full contact.

G. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air barrier membrane with foam sealant.

H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counter flashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

## 3.3 AIR BARRIER MEMBRANE INSTALLATION

A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.

B. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a continuous air barrier according to air barrier manufacturer's written instructions.

C. Apply air barrier membrane within manufacturer's recommended application temperature ranges.

D. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be covered by air barrier sheet in same day. Reprime areas exposed for more than 24 hours.

1. Prime glass-fiber-surfaced gypsum sheathing with number of prime coats needed to achieve required bond, with adequate drying time between coats.

E. Apply a continuous unbroken air barrier to substrates according to the following minimum thickness. Apply membrane in full contact around protrusions such as masonry ties.

1. Vapor-Retarding Membrane Air Barrier: dry film thickness as recommended by manufacturer.

F. Apply strip and transition strip over cured air membrane overlapping 3 inches (75 mm) onto each surface according to air barrier manufacturer's written instructions.

G. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

H. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements.

C. Tests: Testing to be performed will be determined by Owner's testing agency as follows:

1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.

D. Remove and replace deficient air barrier components and retest as specified above.

3.5 PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 30 days.

END OF SECTION 072726

# SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Mechanically fastened thermoplastic polyolefin (TPO) roofing system.
3. Loosely laid and ballasted thermoplastic polyolefin (TPO) roofing system.
4. Roof insulation.

### 1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

### 1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color required.
2. Roof paver, full sized, in each color and texture required.
3. Walkway pads or rolls, of color required.

### 1.5 INFORMATIONAL SUBMITTALS

A. Research/Evaluation Reports: For components of roofing system, from ICC-ES.

B. Sample Warranties: For manufacturer's special warranties.

### 1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Carlisle SynTec Incorporated.
2. Cooley Engineered Membranes.
3. Custom Seal Roofing.
4. Firestone Building Products.
5. Flex Roofing Systems.
6. GAF Materials Corporation.
7. GenFlex Roofing Systems.
8. Johns Manville.
9. Mule-Hide Products Co., Inc.
10. Versico Incorporated.

B. Source Limitations: Obtain components including same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.

B. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:

1. Corner Uplift Pressure: <Insert lbf/sq. ft. (kPa/sq. m)>.
2. Perimeter Uplift Pressure: <Insert lbf/sq. ft. (kPa/sq. m)>.

3. Field-of-Roof Uplift Pressure: <Insert lbf/sq. ft. (kPa/sq. m)>.

D. Energy Star Listing: Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.

E. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.

F. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, [Class A] [Class B] [Class C]; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

## 2.3 TPO ROOFING

A. Fabric-Reinforced TPO Sheet: ASTM D 6878, internally fabric- or scrim-reinforced, uniform, flexible fabric-backed TPO sheet.

1. Thickness: 60 mils (1.5 mm), nominal.
2. Exposed Face Color: Tan or White. Final selection to be made by Architect as per samples provided.

## 2.4 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 55 mils (1.4 mm) thick, minimum, of same color as TPO sheet.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

F. Miscellaneous Accessories: Provide metal termination bars, metal battens, pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

## 2.5 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1396/C 1396M, Type X gypsum board, 5/8 inch (16 mm) thick.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corporation; [GlasRoc Sheathing] [GlasRoc Sheathing Type X].
b. Georgia-Pacific Corporation; [Dens Deck] [Dens Deck DuraGuard] [Dens Deck Prime].
c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
d. Temple-Inland, Inc; GreenGlass Exterior Sheathing.
e. USG Corporation; Securock Glass Mat Roof Board.
f. <Insert manufacturer's name; product name or designation>.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

## 2.6 ROOF INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.6-lb/cu. ft. (26-kg/cu. m) minimum density, square edged.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Corporation.

B. Molded-Polystyrene Board Insulation: ASTM C 578, Type VIII, 1.15-lb/cu. ft. (18-kg/cu. m) minimum density.
1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. Carlisle SynTec Incorporated.
b. DiversiFoam Products.
c. Dyplast Products.

C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.
1. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

a. Atlas Roofing Corporation.
b. Carlisle SynTec Incorporated.

c. Dyplast Products.
d. Firestone Building Products.
e. GAF Materials Corporation.
f. Hunter Panels.
g. Insulfoam LLC; a Carlisle company.
h. Johns Manville.
i. Rmax, Inc.

D. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

## 2.7 INSULATION ACCESSORIES

A. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer.

C. Cover Board: ASTM C 208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.

D. Cover Board: DOC PS 2, Exposure 1, oriented strand board, 7/16 inch (11 mm) thick.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. CertainTeed Corporation; [GlasRoc Sheathing] [GlasRoc Sheathing Type X].
b. Georgia-Pacific Corporation; [Dens Deck] [Dens Deck DuraGuard] [Dens Deck Prime].
c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
d. Temple-Inland, Inc; GreenGlass Exterior Sheathing.
e. USG Corporation; Securock Glass Mat Roof Board.

## 2.8 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Hanover Architectural Products.
b. Rapid Building Systems.
c. Roofblok Limited.

d. Sunny Brook Pressed Concrete Co.
e. Wausau Tile Inc.
f. Westile Roofing Products.

## PART 3 - EXECUTION

### 3.1 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### 3.2 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

### 3.3 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Install tapered insulation under area of roofing to conform to slopes indicated.

C. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

D. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. (0.3 L/sq. m), and allow primer to dry.
2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
3. Set each layer of insulation in insulation adhesive, firmly pressing and maintaining insulation in place.

4. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F (14 deg C) of equiviscous temperature.
5. Set each subsequent layer of insulation in insulation adhesive, firmly pressing and maintaining insulation in place.

E. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

## 3.4 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.

B. Accurately align roofing, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

C. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

D. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

E. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

F. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

## 3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

## 3.6 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

## 3.7 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075423

# SECTION 076200 - SHEET METAL FLASHING AND TRIM

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets and counter flashing.
2. Formed roof drainage sheet metal fabrications.
3. Copings and metal flashings.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.

1. Include details for forming, joining, supporting, and securing sheet metal flashing and trim, including pattern of seams, termination points, fixed points, expansion joints, expansion-joint covers, edge conditions, special conditions, and connections to adjoining work.

C. Samples: For each exposed product and for each finish specified.

D. Maintenance data.

E. Warranty: Sample of special warranty.

### 1.3 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including fascia, fascia trim, and apron flashing, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.

C. Preinstallation Conference: Conduct conference at Project site.

1.4 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Steel Zinc-Coated Sheet: 24 Gauge.

1. Exposed Coil-Coated Finishes:

a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

2. Color: As noted on exterior building elevation drawings.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).

B. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal].

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.4 REGLETS

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counter flashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions.

1. Material: Zinc-Coated Steel Sheet, 24 gauge.
2. Finish: As noted on exterior building elevation drawings.

## 2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Obtain field measurements for accurate fit before shop fabrication.
2. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

C. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

D. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

## PART 3 - EXECUTION

### 3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

### 3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement so that completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight. Use fasteners, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

E. Seal joints as shown and as required for watertight construction.

## 3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch (75-mm) centers.

C. Pipe or Post Counter flashing: Install counter flashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

D. Counter flashing: Coordinate installation of counter flashing with installation of base flashing. Insert counter flashing in reglets or receivers and fit tightly to base flashing. Extend counter flashing 4 inches (100 mm) over base flashing. Lap counter flashing joints a minimum of 4 inches (100 mm) and bed with sealant.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

## 3.4 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 076200

# SECTION 077200 - ROOF ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.

### 1.2 SUBMITTALS

A. Product Data: For each type of roof accessory indicated.

B. Shop Drawings: For roof accessories.

C. Samples: For each exposed product and for each color and texture specified.

D. Operation and maintenance data.

E. Warranty: Sample of special warranty.

## PART 2 - PRODUCTS

### 2.1 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, AZ50 (AZM150) coated.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

D. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used, otherwise mill finished.

E. Stainless-Steel Sheet and Shapes: ASTM A 240/A 240M or ASTM A 666, Type 304.

F. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

## 2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated according to UL 972 with an average impact strength of 12 to 16 ft-lbf/in. (640 to 854 J/m) of width when tested according to ASTM D 256, Method A (Izod).

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches (38 mm) thick.

D. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners.

E. Sealants: As recommended by roof accessory manufacturer for installation indicated.

## 2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Greenheck Fan Corporation.
    b. Roof Products, Inc.
    c. Thybar Corporation.

B. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.

C. Construction:

1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
5. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
6. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.

## 2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Greenheck Fan Corporation.
b. Roof Products, Inc.
c. Thybar Corporation.

B. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.

C. Construction:

1. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
3. Factory-installed continuous wood nailers 5-1/2 inches (140 mm) wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
5. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
6. Fabricate equipment supports to minimum height of 12 inches (300 mm) unless otherwise indicated.
7. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

## 2.5 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bilco Company (The).
b. J. L. Industries, Inc.
c. Nystrom.

B. Type and Size: Single-leaf lid, 30 by 54 inches (750 by 1370 mm) unless otherwise noted on drawings. Unit to include safety railing.

C. Loads: Minimum 60-lbf/sq. ft. external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch (2.01 mm) thick.

E. Construction:

1. Insulation: Glass-fiber board.
2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
3. Hatch Lid: Glazed, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
5. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
6. Fabricate curbs to minimum height of 12 inches (300 mm) unless otherwise indicated.
7. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Galvanized-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder. Post locks in place on full extension; release mechanism returns post to closed position.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. General: Verify dimensions of roof openings for roof accessories. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

C. Seal joints with sealant as required by roof accessory manufacturer.

## 3.2 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.

B. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

# SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes fire-resistive joint systems for the following:

1. Floor-to-floor joints.
2. Floor-to-wall joints.
3. Head-of-wall joints.

### 1.2 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join, and with movement capabilities indicated as determined by UL 2079.

1. Load-bearing capabilities as determined by evaluation during the time of test.

C. Perimeter Fire-Resistive Joint Systems: For joints between edges of fire-resistance-rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated below and those indicated in the Fire-Resistive Joint System Schedule at the end of Part 3, as determined by NFPA 285 and UL 2079.

1. UL-Listed, Perimeter Fire-Containment Systems: Integrity ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
2. OPL-Listed, Perimeter Fire-Barrier Systems: F-ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.

D. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

### 1.3 SUBMITTALS

A. Product Data: For each product indicated.

B. Shop Drawings: For each fire-resistive joint system.

C. Qualification Data: For Installer.

D. Joint system schedule.

E. Field quality-control test reports.

F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with ICBO ES AC30, from the ICBO Evaluation Service.

G. Research/Evaluation Reports: For each type of fire-resistive joint system.

## 1.4 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:

    a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
    b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

D. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

E. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until building inspector of authorities having jurisdiction have examined each installation.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the fire-resistive joint systems from one of the following manufacturers:

1. W.R. Grace
2. Tremco
3. 3M

2.2 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

3.2 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. The supplier is to submit a joint system schedule as part of the shop drawing submittal process. Provide products from a single manufacturer.

END OF SECTION 078446

# SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.

### 1.2 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

### 1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Product test reports.

E. Preconstruction field-adhesion test reports.

F. Warranties.

### 1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 SILICONE JOINT SEALANTS

A. Mildew-Resistant Silicone Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dow Corning Corporation.

b. GE Advanced Materials - Silicones.
c. Pecora Corporation.
d. Tremco Incorporated.
e. Sonneborn, Division of ChemRex Inc.

2. Type: Single component (S).
3. Grade: Nonsag (NS).
4. Class: 25.
5. Uses Related to Exposure: Traffic (T) and Nontraffic (NT).

## 2.3 URETHANE JOINT SEALANTS

A. Urethane Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Sika Corporation; Construction Products Division.
b. Tremco Incorporated.
c. Sonneborn, Divisino of ChemRex, Inc.

2. Type: Single component (S).
3. Grade: Nonsag (NS).
4. Class: 25.
5. Uses Related to Exposure: Traffic (T) and Nontraffic (NT).

## 2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.
b. Tremco Incorporated.
c. Sonneborn, Division of Chamrex Inc.

## 2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation.

b. USG Corporation.

## 2.6 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

## 2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Remove laitance and form-release agents from concrete.
2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

## 3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

## 3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other

requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: As noted in Joint-Sealant Schedule provided by installer as part of submittals.

END OF SECTION 079200

# SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Standard hollow metal door and frames.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required.

E. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

### 1.3 QUALITY ASSURANCE

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1. Temperature-Rise Limit: Where indicated, Provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Mesker Door Inc.

5. Pioneer Industries, Inc.
6. Steelcraft; an Ingersoll-Rand company.
7. West Central Mfg. Inc.
8. Republic.

## 2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I.

H. Glazing: Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat.

## 2.3 STANDARD HOLLOW METAL DOORS

A. General: Comply with ANSI/SDI 100.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.

a. Fire Door Core: As required to provide fire-protection ratings indicated.
b. Thermal-Rated (Insulated) Doors: R-value of not less 12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W) when tested according to ASTM C 1363.

3. Vertical Edges for Single-Acting Doors: Beveled edge, 1/8 inch in 2 inches (3 mm in 50 mm).
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick, end closures or channels of same material as face sheets.

5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Comply with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush)

a. Width: 1-3/4 inches (44.5 mm).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: ANSI/SDI A250.6.

## 2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI 100 Grade II

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet.
5. Frames for Wood Doors: 0.042-inch- (1.0-mm thick steel sheet.
6. Frames for Borrowed Lights: 0.042-inch- (1.0-mm-) thick steel sheet.

D. Hardware Reinforcement: ANSI/SDI A250.6.

## 2.5 FRAME ANCHORS

A. Jamb Anchors:
1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

## 2.6 HOLLOW METAL PANELS

A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

## 2.7 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, same material as door face sheet.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, same material as frames.

D. Terminated Stops: Where indicated, terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

## 2.8 LOUVERS

A. Provide sight proof louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.

1. Fire-Rated Automatic Louvers: Movable blades closed by actuating fusible link, and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated.

## 2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- (6.4-mm-thick by 25.4-mm-) wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

2.10 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Two anchors per jamb up to 60 inches (1524 mm) high.
2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Three anchors per jamb up to 60 inches (1524 mm) high.
2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.

d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.

a. Single-Door Frames: Three door silencers.
b. Double-Door Frames: Two door silencers.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow metal work.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.11 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: ANSI/SDI A250.10.

B. Factory-Applied Paint Finish: ANSI/SDI A250.3.

1. Color and Gloss: See Finish Plan.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post installed expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with post installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

## 3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

# SECTION 081416 - FLUSH WOOD DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with plastic laminate or wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

### 1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

### 1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

1.4 WARRANTY

A. Manufacturer's signed warranty covering manufacturing or material defects for life of original installation, including repair, replacement, machining, detailing glazing and/or prefinishing, as well as rehanging, is a required part of the manufacturer's warranty for their interior doors. Manufacturer's warranty period for exterior doors to be 5 years from original installation. Warranty to include delaminating of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Algoma Hardwoods, Inc.
2. Eggers Industries.
3. Marshfield Door Systems
4. VT Industries

2.2 DOOR CONSTRUCTION, GENERAL

A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

B. WDMA I.S.1-A Performance Grade:

1. Heavy Duty unless otherwise indicated.
2. Extra Heavy Duty: public toilets, janitor's closets assembly spaces and exits

C. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
3. Provide doors with glued-wood-stave cores instead of particleboard cores for doors indicated to receive exit devices.

D. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf (3100 N).
b. Screw Withdrawal, Edge: 400 lbf (1780 N).

E. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Comply with specified requirements for exposed edges.

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

G. Interior Solid-Core Doors See Door Schedule

1. Grade: Premium, with Grade AA faces.
2. Species: See Door schedule and Finish schedule.
3. Cut: Quartered sliced.
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Core: Either glued wood stave or structural composite lumber.
8. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering.
9. Construction: Seven plies, either bonded or nonbonded construction.

## 2.3 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.4 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI conversion varnish..
3. Staining: Match Architect's sample.
4. Effect: Filled finish.
5. Sheen: Match Architect’s sample.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 081416

# SECTION 083113 - ACCESS DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes access doors and frames for walls and ceilings.

### 1.2 SUBMITTALS

A. Product Data: For each type of access door and frame indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material in specified finish.

D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

### 1.3 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 for vertical access doors and frames.
2. UL 263 for horizontal access doors and frames.

### 1.4 COORDINATION

A. If retaining this Article, also retain "Schedule" Paragraph in "Submittals" Article.

B. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

## PART 2 - PRODUCTS

### 2.1 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Steel Sheet: Uncoated or electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating.

E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Factory-Primed Finish: Manufacturer's standard shop primer.

F. Drywall Beads: 0.0299-inch (0.76-mm) zinc-coated steel sheet to receive joint compound.

G. Plaster Beads: 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange of expanded metal lath.

H. Manufacturer's standard finish.

## 2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. J. L. Industries, Inc.
4. Nystrom, Inc.
5. Williams Bros. Corporation of America (The).

C. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Door: Minimum 0.060-inch- (1.5-mm-) thick sheet metal.
3. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with drywall plaster bead flange.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Cam latch with interior release.

D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Locations: Wall and ceiling surfaces.
2. Fire-Resistance Rating: Not less than that of adjacent construction.
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of 0.036 inch (0.9 mm).
5. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch- (25-mm-) wide, surface-mounted trim.
6. Hinges: Concealed-pin type.
7. Automatic Closer: Spring type.
8. Latch: Self-latching device operated by flush key with interior release.
9. Lock: Self-latching device with mortise cylinder lock.

## 2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

## 3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

# SECTION 083614 - TILT-UP DOORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes manually operated tilt up doors provided by owner and installed by General Contractor.

B. Related Section:

1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.

### 1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Tilt-up doors shall meet performance requirements specified without failure due to defective manufacture, fabrication, installation, or other defects in construction and without requiring temporary installation of reinforcing components.

B. Delegated Design: Design Tilt-up doors, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated in 2006 IBC Section 1714.5.2.

### 1.3 SUBMITTALS

A. Product Data: For each type and size of Tilt-up door and accessory.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

D. Maintenance data.

E. Warranties: Sample of special warranties.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of Tilt-up doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FLOATWAY DOORS SINGLE LEAF MODEL S-1000

A. Counterweight balanced with custom finishes.

2.2 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Manufacturer's standard, galvanized-steel track system of configuration indicated, sized for door size and weight, designed for lift type indicated and clearances shown on Drawings. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slope tracks at proper angle from vertical or design tracks to ensure tight closure at jambs when door unit is closed.

B. Track Reinforcement and Supports: Galvanized-steel track reinforcement and support members. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

2.3 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Rollers: Heavy-duty rollers with steel ball-bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Provide 3-inch- (76-mm-) diameter roller tires for 3-inch- (76-mm-) wide track and 2-inch- (51-mm-) diameter roller tires for 2-inch- (51-mm-) wide track.

2.4 COUNTERBALANCE MECHANISM

A. Door to be counterweight balanced.

B. Provide a spring bumper at each horizontal track to cushion door at end of opening operation.

2.5 DOOR ASSEMBLY

A. Float Away Doors S-1000.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. Renlita Doors North America, LLC

B. Tilt-Up

C. Track Configuration: As detailed on drawing.

D. Manual Door Operator: Push-up operation.

E. Door Finish: Custom

1. See door schedule and finish schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install tilt-up doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Tracks: Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment. Repair galvanized coating on tracks according to ASTM A 780.

C. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Adjust doors and seals to provide tight fit around entire perimeter.

END OF SECTION 083614

# SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Exterior storefront framing.

2. Exterior windows.
3. Exterior manual-swing entrance doors and door frame units.

### 1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferring to building structure.
    c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    d. Noise or vibration created by wind and by thermal and structural movements.
    e. Loosening or weakening of fasteners, attachments, and other components.
    f. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind Loads: Per IBC current applicable edition with current state amendments.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
2. Test Durations: 10 seconds.

F. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 1.57 lbf/sq. ft. (75 Pa).

G. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).

## 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Samples: For each type of exposed finish required.

D. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Product test reports.

G. Field quality-control reports.

H. Maintenance data.

I. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and Minnesota Building Code Chapter 1341.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 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:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Kewneer Encore 6” x 1 ¾” insolated entrance with encore thermal storefront system. See drawings for frame sizes and profile or comparable product by one of the following:

1. EFCO Corporation.
2. Tubelite.
3. United States Aluminum.
4. Quaker Windows E300 series alternate for guestroom windows only.

## 2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center or front edge. See drawings for type.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

## 2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

## 2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2” Exterior and 1 ¾” interior overall thickness, with minimum 0.125-inch- (3.2-mm thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

    a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: See drawings for size and profile..

    a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches (255 mm) above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware."

## 2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware and entrance door hardware sets indicated in the Hardware section Division 08., for each entrance door to comply with requirements in this Section.

1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
3. Opening-Force Requirements:

    a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.

B. Opening-Force Requirements:

1. Latches and Exit Devices: Not more than 15 lbf (67 N) required to release latch.

## 2.7 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

## 2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from exterior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.9 ALUMINUM FINISHES

A. Exposed Aluminum: clear anodized to an NAAMM AA-M10-C22-A41, Architectural Class 1 coating (thickness: 0.7 mils, minimum).

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.2 ENTRANCE DOOR HARDWARE SETS

A. Door Hardware Set No. See Door Schedule.

END OF SECTION 084113

# SECTION 084229 - AUTOMATIC ENTRANCES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Exterior and interior, sliding, power-operated automatic entrances.

### 1.2 PERFORMANCE REQUIREMENTS

A. Opening-Force Requirements:

1. Power-Operated Doors: Not more than 50 lbf (222 N) required to manually set door in motion if power fails, and not more than 15 lbf (67 N) required to open door to minimum required width.
2. Breakaway Device for Power-Operated Doors: Not more than 50 lbf (222 N) required for a breakaway door or panel to open.
3. Accessible Interior Doors: Not more than 5 lbf (22 N) to fully open door.

B. Entrapment Force Requirements:

1. Power-Operated Sliding Doors: Not more than 30 lbf (133 N) required to prevent stopped door from closing.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For automatic entrances. Include plans, elevations, sections, details, hardware mounting heights, wiring safety devices, and attachments to other work.

C. Sample: For each exposed product and for each color and texture specified.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Power-Operated Door Standard: BHMA A156.10.

D. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrances serving as a required means of egress.

E. Preinstallation Conference: Conduct conference at Project site.

## 1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

B. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

C. Glazing: As specified in Division 08 Section.

D. Sealants and Joint Fillers: As specified in Division 07 Section "Joint Sealants."

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

## 2.2 SLIDING AUTOMATIC ENTRANCES

A. General: Provide manufacturer's standard automatic entrances including doors, sidelites, framing, headers, carrier assemblies, roller tracks, door operators, activation and safety devices, and accessories required for a complete installation.

B. Sliding Automatic Entrance as listed in the drawings and door schedule:

a. Manufacturers: Subject to compliance with requirements, provide product noted on exterior building elevation drawings or comparable product by one of the following: Double Sliding Units:

1) Besam Automated Entrance Systems Inc.; An ASSA Abloy Group.
2) DORMA Automatics; Div. of DORMA Group North America.
3) Horton Automatics; Div. of Overhead Door Corporation.
4) Stanley Access Technologies; Div. of The Stanley Works.

2. Configuration: Double- sliding door, with sidelite.

a. Traffic Pattern: Two way.
b. Emergency Breakaway Capability.
c. Mounting: Between jambs.

3. Operator Features:

a. Power opening and closing.
b. Drive System: Manufacturer standard.
c. Adjustable opening and closing speeds.
d. Adjustable hold-open time between 0 and 30 seconds.
e. Obstruction recycle.
f. On-off/hold-open switch to control electric power to operator.

4. Sliding Door Carrier Assemblies and Overhead Roller Tracks: Manufacturer's standard carrier assembly that allows vertical adjustment; consisting of nylon- or delrin-covered, ball-bearing-center steel wheels operating on a continuous roller track, or ball-bearing-center steel wheels operating on a nylon- or delrin-covered, continuous roller track. Support doors from carrier assembly by cantilever and pivot assembly.

5. Sliding Door Threshold: Manufacturer's standard threshold members and bottom-guide track system, with stainless-steel, ball-bearing-center roller wheels.
6. Activation Device: Motion sensors mounted on door header to detect pedestrians in activating zone to activate door operator.
7. Safety Devices: Presence sensor mounted to underside of door header to detect pedestrians in presence zone and to prevent door from closing.
8. Sidelite Safety Device: Presence sensor, mounted above each sidelite on side of door opening through which doors travel, to detect obstructions and to prevent door from opening.
9. Finish: Finish framing, door, sidelite, and header with finish matching adjacent storefront framing.

## 2.3 ENTRANCE COMPONENTS

A. Framing Members: Manufacturer's standard extruded aluminum, minimum 0.125 inch (3.2 mm) thick and reinforced as required to support imposed loads. Size and finish to match storefront system.

B. Stile and Rail Doors: Manufacturer's standard 1-3/4-inch- (45-mm-) thick, glazed doors with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members.

Mechanically fasten corners with reinforcing brackets that are welded, or incorporate concealed tie-rods that span full length of top and bottom rails. Glazing stops, stiles and rails size and finish to match storefront system.

C. Sidelite: Manufacturer's standard 1-3/4-inch- (45-mm-) deep sidelite with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular stile and rail members matching door design and finish.

D. Headers: Fabricated from minimum 0.125-inch- (3.2-mm-) thick, extruded aluminum and extending full width of automatic entrance units to conceal door operators and controls. Provide hinged or removable access panels for service and adjustment of door operators and controls. Secure panels to prevent unauthorized access.

E. Signage: Affixed to both sides of each door as required by applicable IBC for type of door and its operation. Signage size, type, and location to be approved by Architect prior to install.

## 2.4 DOOR OPERATORS AND ACTIVATION AND SAFETY DEVICES

A. Door Operators: Provide door operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Motion Sensors: Self-contained, K-band-frequency, microwave-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds.

C. Presence Sensors: Self-contained, infrared-scanner units with metal or plastic housing; adjustable to provide detection field sizes and functions required by BHMA A156.10; with relay hold time of not less than 2 to 10 seconds. Sensors shall remain active at all times.

D. Electrical Interlocks: Unless units are equipped with self-protecting devices or circuits, provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted.

## 2.5 HARDWARE

A. General: Provide units in sizes and types recommended by automatic entrance and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish unless otherwise indicated.

B. Breakaway Device for Power-Operated Doors: Provide breakaway device that allows door to swing out in direction of egress to full 90 degrees from any operating position. Maximum force to open door shall be 50 lbf (222 N) according to BHMA A156.10. Interrupt powered operation of door operator while in breakaway mode.

C. Deadlocks: Manufacturer's standard deadbolt operated by exterior cylinder and interior thumb turn, with minimum 1-inch- (25-mm-) long throw bolt; BHMA A156.5, Grade 1.

D. Weather Stripping: Manufacturer's standard replaceable components.

E. Finger Guards: Manufacturer's standard collapsible neoprene or PVC gasket.

2.6 FABRICATION

A. General: Factory fabricate automatic entrance components to designs, sizes, and thicknesses indicated and to comply with indicated standards.

B. Activation and Safety Devices:

1. General: Factory install devices in doors and headers as required by BHMA A156.10 for type of door and direction of travel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

B. Entrances: Install automatic entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

1. Install surface-mounted hardware using concealed fasteners to greatest extent possible.
2. Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

C. Door Operators: Connect door operators to electrical power distribution system. (Installed by electrical contractor).

D. Access-Control Devices: Connect access-control devices to access-control system (Installed by electrical contractor).

E. Activation and Safety Devices: Install and adjust devices to provide detection field and functions indicated.

F. Guide Rails: Install rails according to BHMA A156.10 including Appendix A and manufacturer's written instructions unless otherwise indicated.

G. Glazing: Install glazing as specified in Division 08 Section.

H. Sealants: Comply with requirements specified in Division 07 Section "Joint Sealants" to provide weathertight installation.

I. Signage: Apply signage on both sides of each door and breakaway sidelight as required by referenced door standards.

J. Wiring within Automatic Entrance Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's written limitations on bending radii. Provide and use lacing bars and distribution spools.

K. Adjusting: Adjust door operators, controls, and hardware for smooth and safe operation and for weathertight closure; comply with requirements in BHMA A156.10.

END OF SECTION 084229

# SECTION 087100 - DOOR HARDWARE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Commercial door hardware.
2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

B. See Division 08 door sections for astragals and door silencers.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Details of electrified door hardware, including wiring diagrams.

C. Samples: For each exposed finish.

D. Product certificates test reports.

E. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams.

a. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
b. Content: Include the following information:

1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item.
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Provide primus controlled key system.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure.

E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system.

F. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

B. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1. To be installed by owner’s locksmith

1.5 COORDINATION

A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion, except as follows:

a. Electromagnetic Locks: Five years from date of Substantial Completion.
b. Exit Devices: Two years from date of Substantial Completion.
c. Manual Closers: 10 years from date of Substantial Completion.

1.7 EXTRA MATERIALS

A. Furnish full-size units of door hardware described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: See Hardware Groups.
2. Electrical Parts: See Hardware Groups.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule.

1. Door Hardware Sets: Provide quantity, item, size, finish or color as indicated on the drawings and door schedule.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 HINGES, GENERAL

A. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Finish US32D Satin Stainless Steel for wood and steel doors unless noted otherwise. Match storefront finish for aluminum doors.

C. Non removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for out swinging exterior doors.

D. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head; Finish screw heads to match surface of hinges.

## 2.3 HINGES

A. Butts and Hinges: BHMA A156.1.

B. Template Hinge Dimensions: BHMA A156.7.

C. Manufacturers:

1. Hager Companies (HAG).
2. McKinney Products Company; an ASSA ABLOY Group company (MCK).
3. Stanley Commercial Hardware; Div. of The Stanley Works (STH).

## 2.4 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Electrified Locking Devices: BHMA A156.25.

D. Lock Trim:

1. Levers: Match door hardware sets.
2. Dummy Trim: Match lever lock trim and escutcheons.

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors.

F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

G. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.

## 2.5 ELECTROMAGNETIC LOCKS

A. General: BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door.

1. Type: Full exterior or full interior, as required by application indicated.
2. Strength Ranking: 1500 lbf (6672 N).

## 2.6 ELECTROMECHANICAL LATCHES

A. General: Grade 1 unless Grade 2 is indicated for type of lock indicated.

B. Manufacturers:
1. Sargent an Assa Abloy Company (SGT).
2. Schlage an Ingersoll-Rand Company (SCH).

## 2.7 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks: BHMA A156.29, Grade 1, surface mounted, battery powered, housed in metal case; with red-and-white lettering reading "EMERGENCY EXIT PUSH TO OPEN--ALARM WILL SOUND."

B. Stand-Alone Exit Alarms: BHMA A156.29, Grade 1, surface mounted on door.

C. Manufacturers:

1. Detex Corporation (DTX).
2. Sargent; an ASSA ABLOY Group company (SGT).

## 2.8 DOOR BOLTS

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors.

B. Dustproof Strikes: BHMA A156.16, Grade 1.

## 2.9 EXIT DEVICES

A. Exit Devices: BHMA A156.3, Grade 1 unless Grade 2 is indicated.

B. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Outside Trim: Pull with cylinder; material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

G. Through Bolts: For exit devices and trim on metal doors.

H. Manufacturers: Von Duprin #33A US32D Satin Stainless Steel finish on wood or steel doors. The finish is to match storefront for aluminum doors.

1. Von Duprin; an Ingersoll-Rand Company (VD).
2. Equal product from Dorma.
3. Equal product from Corbin Russwin.

## 2.10 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5, Grade 1 unless Grade 2 is indicated.

B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Six.
2. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).

C. Permanent Cores: Manufacturer's standard; finish face to match lockset; with removable cores.

D. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Furnish permanent cores to Owner for installation.

E. Manufacturer:

1) Sargent; an ASSA ABLOY Group company.

2) Schlage –Primus controlled key system.

2.11 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference into master key system.

B. Keys: Nickel silver permanently inscribed with a visual key control number and including the notation "DO NOT DUPLICATE."

1. Quantity: In addition to one extra key blank for each lock, provide three cylinder change keys and five master keys.

2.12 OPERATING TRIM

A. Materials: As noted in hardware groups.

B. Manufacturers: As noted in hardware groups.

2.13 CLOSERS

A. Accessibility Requirements: Comply with the following maximum opening-force requirements:

1. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

E. Surface Closers: BHMA A156.4, Grade 1 unless Grade 2 is indicated. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated. LCN 4040 Series. Match finish of locks and latches or storefront at aluminum doors.

1. Manufacturers:

a. Sargent; an ASSA ABLOY Group company (SGT).

b. LCN Closers; an Ingersoll-Rand Company (LCN).
c. Equal product from Dorma.
d. Equal product from Norton.

2.14 PROTECTIVE TRIM UNITS

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.

B. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from material indicated in door hardware sets.

1. Material: 0.050-inch- (1.3-mm-) thick stainless steel.
2. Manufacturers:

a. Hager Companies (HAG).
b. Hiawatha, Inc. (HIA).
c. IVES Hardware; an Ingersoll-Rand Company (IVS).

2.15 STOPS AND HOLDERS

A. Stops and Bumpers: BHMA A156.16 Grade 1 unless Grade 2 is indicated. Ives WS401 wall stop and Ives WS436 Floor stop. Finish US32D Satin Stainless Steel.

1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.

C. Silencers for Door Frames: BHMA A156.16, Grade 1; neoprene or rubber; fabricated for drilled-in application to frame.

D. Manufacturers:

1. Hager Companies (HAG).

2. Glynn-Johnson (GLJ).
3. Hiawatha, Inc. (HIA).
4. IVES Hardware; an Ingersoll-Rand Company (IVS).

2.16 DOOR GASKETING

A. Standard: BHMA A156.22.

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

G. Manufacturers:

1. National Guard Products (NGP).
2. Pemko Manufacturing Co. (PEM).
3. Reese Enterprises (RE).

## 2.17 THRESHOLDS

A. Standard: BHMA A156.21.

B. Accessibility Requirements: Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high Pemko as indicated on the drawings.

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

D. Manufacturers:

1. National Guard Products (NGP).
2. Pemko Manufacturing Co. (PEM).
3. Reese Enterprises (RE).

## 2.18 SLIDING DOOR HARDWARE

A. General: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Door Hardware: See hardware group 1.

## 2.19 FABRICATION

A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and

BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.

C. Finishes: BHMA A156.18, as indicated in door hardware sets.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

C. Mounting Heights: Mount door hardware units at heights indicated on Drawings unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening.

F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

G. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

3.2 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

B. DOOR HARDWARE SETS See Door Schedule.

END OF SECTION 087100

# SECTION 088000 - GLAZING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows.
2. Doors.
3. Glazed entrances.
4. Interior borrowed lites.
5. Storefront framing.

### 1.2 DEFINITIONS

A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

D. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

### 1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:

a. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour (meters per second) at 33 feet (10 m) above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

1) Basic Wind Speed: Per applicable IBC with state amendments.
2) Importance Factor: I.
3) Exposure Category: B.

b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.

1) Load Duration: 60 seconds or less.

c. Probability of Breakage for Sloped Glazing: 1 lite per 1000 for lites set more than 15 degrees off vertical and under wind and snow action.

1) Load Duration: 30 days.

d. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Thermal and Optical Performance Properties: Use glass specified on exterior building elevation drawings.

## 1.4 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: 12-inch- (300-mm-) square, for each type of glass product indicated, other than monolithic clear float glass.

C. Glazing Schedule: Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

## 1.5 QUALITY ASSURANCE

A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

C. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F (250 deg C), and the fire-resistance rating in minutes.

E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.6 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass

units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form, made out to Owner and signed by laminated-glass manufacturer agreeing to replace laminated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five years from date of Substantial Completion.

C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

C. Reflective-Coated Spandrel Glass: ASTM C 1376, Kind CS; coated by pyrolytic process, and complying with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Viracon, Solar screen or comparable product by one of the following:

a. Old Castle Glass.
b. PPG Architectural Glass

2. See building elevation drawings for specifications.

## 2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

B. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with the following to comply with interlayer manufacturer's written recommendations:

    a. Polyvinyl butyral interlayer.

2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

## 2.4 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Viracon.
2. Old Castle Glass.
3. PPG Architectural Glass.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Provide units as specified on building elevation drawingsor equal from manufacturer noted.
2. Sealing System: Dual seal.
3. Spacer: Manufacturer's standard spacer material and construction.

## 2.5 FIRE-PROTECTION-RATED GLAZING

A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.

B. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch (5-mm) nominal thickness; faced on one surface with a clear glazing film; complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite NT.
   b. Safti First; SuperLite C/SP.
   c. Vetrotech Saint-Gobain; SGG Keralite FR-F.

C. Laminated Ceramic Glazing: Laminated glass made from 2 plies of clear, ceramic flat glass; 5/16-inch (8-mm) total nominal thickness; complying with testing requirements in 16 CFR 1201 for Category II materials.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); FireLite Plus.
   b. Schott North America, Inc.; Laminated Pyran Crystal.
   c. Vetrotech Saint-Gobain; SGG Keralite FR-L.

## 2.6 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from the following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

## 2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.
4. Colors of Exposed Glazing Sealants: As indicated by manufacturer's designations.

B. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

## 2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## 2.9 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

C. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

PART 3 - EXECUTION

3.1 GLAZING

A. General: Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
4. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
6. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
7. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
2. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
3. Apply heel bead of elastomeric sealant.
4. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
5. Apply cap bead of elastomeric sealant over exposed edge of tape.

C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

1. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
2. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward

centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

3. Install gaskets so they protrude past face of glazing stops.

D. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

## 3.2 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

# SECTION 088300 - MIRRORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Film-backed Tempered glass mirrors qualifying as safety glazing.

2. Framed mirror with shelf as indicated on the drawings.

### 1.2 SUBMITTALS

A. Product Data: For mirror hardware and mastic.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of mirror product required, in the form indicated below:

1. Mirrors, 12 inches (300 mm) square, including edge treatment on 2 adjoining edges.
2. Mirror clips.
3. Mirror trim, 12 inches (300 mm) long.

D. Product Certificates: For each type of mirror and mirror mastic, signed by product manufacturer.

E. Mirror Mastic Compatibility Test Reports: From mirror manufacturer.

### 1.3 QUALITY ASSURANCE

A. Glazing Publications: Comply with GANA's "Glazing Manual" and GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors" unless more stringent requirements are indicated

B. Safety Glazing Products: For film-backed tempered mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.

C. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing paint and substrates on which mirrors are installed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated in second subparagraph below.

1. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRROR MATERIALS

A. Tempered Clear Glass Mirrors: Comply with ASTM C 1503, Mirror Glazing Quality, for blemish requirements in annealed float glass before silver coating is applied, for coating requirements, and with other requirements not affected by tempering process; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.

1. Nominal Thickness: ¼ “.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Gunther Mirror Mastics.

b. Palmer Products Corporation.

## 2.3 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch (9.5 and 22 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch (16 and 25 mm) in height, respectively, and a thickness of not less than 0.04 inch (1.0 mm).
3. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
4. Products: Subject to compliance with requirements, provide one of the following:

    a. Bottom Trim:

        1) Laurence, C. R. Co., Inc.; CRL Standard "J" Channel.
        2) Sommer & Maca Industries, Inc.; Medium Gauge Aluminum Shallow Nose "J" Moulding Lower Bar.

    b. Top Trim:

        1) Laurence, C. R. Co., Inc.; CRL Deep "J" Channel.
        2) Sommer & Maca Industries, Inc.; Medium Gauge Aluminum Deep Nose "J" Moulding Upper Bar.

5. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch (7.9 and 19 mm) in height, respectively.
6. Top Trim: Formed with front leg with a height of 5/16 inch (7.9 mm) and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.
7. Product: Subject to compliance with requirements, provide the following:

    a. Bottom Trim: C. R. Laurence Co., Inc.; D638 FHA Type "J" Channel.
    b. Top Trim: C. R. Laurence Co., Inc.; D 1638 Top Channel.
    c. Cleat: C. R. Laurence Co., Inc.; D 1637M Mirror Mount System Cleat.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Sizes: To suit Project conditions, and before tempering, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts before tempering for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished edge.
1. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with pressure-sensitive adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections. Use adhesives and film backing compatible with mirror backing paint as certified by mirror manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. For wall-mounted mirrors, install with mastic and mirror hardware.

1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
2. For mirror hardware in the form of a continuous J-channel at bottom and continuous top trim at top, fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.
3. Where indicated, install mirror hardware in the form of J-channels that are fabricated in single lengths to fit and cover top and bottom edges of mirrors.
4. Install mastic as follows:

a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface.

D. Protect mirrors from breakage and contaminating substances resulting from construction operations.

E. Do not permit edges of mirrors to be exposed to standing water.

F. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

END OF SECTION 088300

# SECTION 089000 - LOUVERS AND VENTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Fixed, formed-metal louvers.

### 1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors.

1. Wind Loads: Per current building codes and requirement of authorities having jurisdiction.

C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Galvanized-Steel Sheet: ASTM A 653/A 653M, G60 (Z180) G90 (Z275) zinc coating, mill phosphatized.

B. Fasteners: Use types and sizes to suit unit installation conditions.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.2 FABRICATION, GENERAL

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.3 FIXED, FORMED-METAL LOUVERS

A. Horizontal, Drainable-Blade Louver: Confirm with MEP Contractor that louver meets mechanical requirements.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Louver grilles as indicated on the drawings or comparable product by one of the following:
   a. Airolite Company, LLC (The).
   b. Construction Specialties, Inc.
   c. Ruskin Company; Tomkins PLC.

## 2.4 LOUVER SCREENS

A. General: Provide screen at each exterior louver.

B. Louver Screen Frames: Same kind and form of metal as indicated for louver to which screens are attached.

C. Louver Screening:
1. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire.

## 2.5 GALVANIZED-STEEL SHEET FINISHES

A. Finish louvers after assembly.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas and repair according to ASTM A780.

C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).

1. Color and Gloss: custom color as indicated on the drawings to match adjacent wall color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory and refinish entire unit or provide new units.

E. Protect galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint.

END OF SECTION 089000

# SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Shaft-wall enclosures.
2. Chase enclosures.
3. Horizontal enclosures.

### 1.2 SUBMITTALS

A. Product Data: For each gypsum board shaft-wall assembly indicated.

### 1.3 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum Company.
2. G-P Gypsum.
3. National Gypsum Company.
4. USG Corporation.

## 2.2 GYPSUM BOARD SHAFT-WALL ASSEMBLIES, GENERAL

A. Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
2. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

## 2.3 PANEL PRODUCTS

A. Gypsum Liner Panels: Comply with ASTM C 442/C 442M.

1. Type X: Manufacturer's proprietary liner panels with moisture-resistant paper faces.

a. Core: 1 inch (25.4 mm) thick.
b. Long Edges: Double bevel.

2. Moisture- and Mold-Resistant Type X: Manufacturer's proprietary liner panels and with moisture- and mold-resistant core and surfaces; comply with ASTM D 3273.

a. Core: 1 inch (25.4 mm) thick.
b. Long Edges: Double bevel.

B. Gypsum Board: As specified in Division 09 Section "Gypsum Board."

## 2.4 NON-LOAD-BEARING STEEL FRAMING

A. Framing Members: Comply with ASTM C 754 for conditions indicated.

B. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

## 2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced product standards and manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 09 Section "Gypsum Board" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

C. Gypsum Base Joint-Reinforcing Materials: As specified in Division 09 Section "Gypsum Veneer Plastering."

D. Gypsum Board Joint-Treatment Materials: As specified in Division 09 Section "Gypsum Board."

E. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

G. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

H. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

I. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

## 2.6 GYPSUM BOARD SHAFT-WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated on drawings.

B. STC Rating: As indicated on drawings.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.

1. Depth: [As indicated] [2-1/2 inches (64 mm)] [4 inches (102 mm)] [6 inches (152 mm)].
2. Minimum Base-Metal Thickness: [As indicated] [0.0179 inch (0.45 mm)] [0.0220 inch (0.55 mm)] [0.0329 inch (0.84 mm)] <Insert value>.

D. Runner Tracks: Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches (51 mm) long and in depth matching studs.

1. Minimum Base-Metal Thickness: [As indicated] [Matching steel studs] [0.0179 inch (0.45 mm)] [0.0220 inch (0.55 mm)] [0.0329 inch (0.84 mm)] <Insert value>.

E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches (76 mm), in depth matching studs, and not less than 0.0329 inch (0.84 mm) thick.

G. Room-Side Finish: As indicated.

H. Shaft-Side Finish: As indicated by fire-resistance-rated assembly design designation.

I. Insulation: Sound attenuation blankets.

## PART 3 - EXECUTION

### 3.1 PREPARATION

A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft-wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft-wall assemblies to comply with requirements specified in Division 07 Section "Applied Fireproofing."

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runner tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.

B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft-wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

### 3.2 INSTALLATION

A. General: Install gypsum board shaft-wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:

1. ASTM C 754 for installing steel framing except comply with framing spacing indicated.
2. Division 09 Section "Gypsum Board" for applying and finishing panels.

B. Do not bridge architectural or building expansion joints with shaft-wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.

D. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect, while maintaining fire-resistance rating of gypsum board shaft-wall assemblies.

H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with ASTM C 919 requirements or with manufacturer's written instructions, whichever are more stringent.

I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

## 3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

# SECTION 092900 - GYPSUM BOARD

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Sound attenuation blankets.

### 1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

### 2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Georgia-Pacific Gypsum LLC.
2. National Gypsum Company.
3. USG Corporation.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

D. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4 inch (6.4 mm).
2. Long Edges: Tapered.

E. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

F. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

G. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.

1. Products: Subject to compliance with requirements, provide the following:

    a. Georgia-Pacific Gypsum LLC; DensArmour Plus.

2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10.

H. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide the following:

    a. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
    b. National Gypsum Company; Gold Bond, e(2)XP.
    c. USG Corporation; Securock Glass Mat Sheathing.

2. Core: 5/8 inch (15.9 mm), Type X.

## 2.3 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges. For use in wet areas.

1. Products: Subject to compliance with requirements, provide the following:

    a. Custom Building Products; Wonderboard.
    b. National Gypsum Company, Permabase Cement Board.
    c. USG Corporation; DUROCK Cement Board.

2. Thickness: 5/8 inch (15.9 mm).
3. Mold Resistance: ASTM D 3273, score of 10.

B. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges. For use in dry areas.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. American Gypsum.
b. Georgia-Pacific Gypsum LLC.
c. USG Corporation.

2. Core: 5/8 inch (15.9 mm), Type X.

## 2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.

C. Aluminum Trim: ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

## 2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

## 2.6 AUXILIARY MATERIALS

A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing).

D. Acoustical Joint Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.

E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

## PART 3 - EXECUTION

### 3.1 APPLYING AND FINISHING PANELS

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. Install trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

1. Control Joints: Install control joints at locations indicated on Drawings.

E. Prefill open joints, rounded or beveled edges, and damaged surface areas.

F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in other Division 09 Sections.

H. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

I. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

# SECTION 093000 - TILING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. All Tile listed on Finish Specification.
2. Crack-suppression and waterproofing membrane for thin-set tile installations.
3. Cementitious backer units see section 092900.
4. Metal edge strips installed as part of tile installations.
5. Grout Sealer.

### 1.2 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. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
5. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

### 2.2 TILE PRODUCTS

A. Manufacturers:

1. Manufacture and type as noted on the drawings and finish schedule.

B. Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing where applicable.

1. Base Cove: Cove
2. Base Cap: Bullnose.
3. Wainscot Cap: Bullnose.
4. External Corners: Bullnose.
5. Internal Corners: Cove.
6. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from 1/2 to 1/4 inch (12.7 to 6.35 mm) across nominal 4-inch (100-mm) dimension.

## 2.3 ACCESSORY MATERIALS

A. Thresholds: Fabricate to provide transition between adjacent floor finishes. Bevel edges at 1:2 slope, limit height of bevel to 1/2 inch (12.7 mm) or less, and finish bevel to match face of threshold.

1. Marble Thresholds: ASTM C 503 with a minimum abrasion resistance of 10 per ASTM C 1353 or ASTM C 241 and with honed finish.

B. Waterproofing, Crack-Suppression Membranes, and Sealer for Thin-Set Tile Installations: Manufacturer's standard product that complies with ANSI A118.10, selected from the following.

1. Waterproofing
   a. Products:
      1) Schluter: Dirta with Ardex FB9L.
      2) Latricrete 9235.
      3) Noble Seal TS.
2. Crack Suppression Membrane
   a. Products:
      1) NCB Anti-Fracture membrane
      2) Noble Seal CIS

3. Latex-Portland Cement Product: Flexible mortar with acrylic-latex additive.
   a. Products:
      1) Boiardi Products Corporation; Elastiment 323.
      2) MAPEI Corporation; PRP 315.
      3) TEC Specialty Products Inc.; TA-324, Triple Flex.
4. Grout Sealer (Use sealer only with materials recommended by manufacturer).
   a. Products:
      1) Aqua Mix: Sealers choice 15 gold.
      2) Stone Lok: MLT Plus for use in kitchen and pool areas.

2.4 SETTING AND GROUTING MATERIALS

A. Manufacturers: As noted on Finish Specification.

B. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A.

C. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. For wall applications, provide nonsagging mortar.

D. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Prepackaged dry-mortar mix containing dry additive to which only water must be added.
2. Prepackaged dry-mortar mix combined with liquid-latex additive.
3. For wall applications, provide nonsagging mortar.

2.5 MISCELLANEOUS MATERIALS

A. Elastomeric Sealants: Elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. One-Part, Mildew-Resistant Silicone: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for in-service exposures of high humidity and extreme temperatures.

a. Products:

1) Dow Corning Corporation; Dow Corning 786.
2) GE Silicones; Sanitary 1700.
3) Tremco, Inc.; Tremsil 600 White.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials.

C. Metal Edge Strips: Angle or L-shape, stainless steel exposed-edge material.

D. Grout Sealer: Manufacturer's best product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions.

C. Remove protrusions, bumps, and ridges by sanding or grinding.

D. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

E. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

## 3.2 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Grind cut edges of tile abutting trim, finish, or built-in items. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Grout tile to comply with requirements of ANSI A108.10, unless otherwise indicated.

I. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.

1. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.

J. Install tile on floors with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Quarry Tile: 1/4 inch (6.35 mm)
3. Paver Tile: 1/4 inch (6.35 mm)

K. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.

1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.

L. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

M. Install tile on walls with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Glazed Wall Tile: 1/16 inch (1.6 mm).

N. Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

## 3.3 FLOOR TILE INSTALLATION SCHEDULE

A. Interior floor installation on concrete; thin-set mortar; TCA F113.

1. Thin-Set Mortar: Latex- portland cement mortar.
2. Grout: As noted on finish specifications.
3. Sealers: As noted above.

B. Interior floor installation on crack-suppression membrane over concrete; thin-set mortar; TCA F122.

1. Thin-Set Mortar: Latex-portland cement mortar.
2. Grout: As noted on finish specifications.
3. Sealers: As noted above.

## 3.4 WALL TILE INSTALLATION SCHEDULE

A. Interior wall installation over masonry or concrete; thin-set mortar; TCA W202.

1. Thin-Set Mortar: Latex- portland cement mortar.
2. Grout: lymer-modified unsanded] grout.

B. Interior wall installation over gypsum board on metal studs; organic adhesive; TCA W242.

1. Grout: As noted on finish specifications.
2. Sealers: As noted above.

C. Interior wall installation; thin-set mortar; over gypsum board; TCA W243.

1. Thin-Set Mortar: Latex- portland cement mortar.
2. Grout: As noted on finish specifications.
3. Sealers: As noted above.

END OF SECTION 093000

# SECTION 095123 - ACOUSTICAL TILE CEILINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes acoustical tiles and concealed suspension systems for ceilings.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.

C. Samples: For each exposed finish.

D. Product test reports.

E. Research/evaluation reports.

F. Maintenance data.

### 1.3 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory.

B. Fire-Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

    a. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Acoustical tiles complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.

    a. Smoke-Developed Index: 450 or less.

1.4 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. Acoustical Ceiling Units: Full-size tiles equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL TILE CEILINGS, GENERAL

A. Acoustical Tile Standard: Comply with ASTM E 1264.

B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. .

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

E. Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 ACOUSTICAL TILES FOR ACOUSTICAL TILE CEILING

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Reflected Ceiling Plans

B. Classification: Provide fire-resistance-rated tiles complying with ASTM E 1264 for type and form as follows:

C. Color As indicated on Drawings.

D. Edge/Joint Detail: Beveled Tegular.

E. Thickness: As indicated on Drawings.

F. Modular Size: As indicated on Drawings.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.

B. Direct-Hung, Suspension System: Intermediate-duty structural classification.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 636, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices.

D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

END OF SECTION 095123

# SECTION 096513 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Resilient base.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

### 1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 RESILIENT BASE

A. Resilient Base: As noted in the drawings and finish schedule.

B. Resilient Base Standard: ASTM F 1861.
1. Style: Cove (base with toe) or straight (flat or toeless).
2. Use cove with hard surface flooring and straight with carpet.

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: As noted in the drawings and finish schedule.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: preformed.

G. Inside Corners: preformed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As noted in the drawings and finish schedule.

## 2.2 RESILIENT MOLDING ACCESSORY

A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Johnsonite.

B. Description: Carpet edge for glue-down applications, Nosing for carpet, Nosing for resilient floor covering, Reducer strip for resilient floor covering, Joiner for tile and carpet and Transition strips.

C. Material: Vinyl.

D. Profile and Dimensions: As indicated or selected by Architect from full range of profiles..

E. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

## 3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

    a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

## 3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

## 3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

## 3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Cover resilient products until Substantial Completion.

END OF SECTION 096513

# SECTION 096516 - RESILIENT SHEET FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Resilient sheet floor covering, without backing.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Maintenance data.

### 1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor coverings.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Close spaces to traffic during floor covering installation.

D. Close spaces to traffic for 48 hours after floor covering installation.

E. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RUBBER SHEET FLOOR COVERING

A. Products: As noted in the drawings and finish schedule.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.

C. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by manufacturer.
2. Cap Strip: Square stainless steel provided or approved by manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.

B. Concrete Substrates: Prepare according to ASTM F 710.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed.

1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.2 FLOOR COVERING INSTALLATION

A. Comply with manufacturer's written instructions for installing floor coverings.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor covering.

B. Cover floor coverings until Substantial Completion.

END OF SECTION 096516

# SECTION 096519 - RESILIENT TILE FLOORING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples: Full-size units of each color and pattern of floor tile required.

D. Maintenance data.

### 1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor tile.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

A. Products: As noted in the drawings and finish schedule.

B. Tile Standard: ASTM F 1066.

C. Thickness: 1/8”.

D. Size: As noted in the drawings and finish schedule.

E. Colors and Patterns: As noted in the drawings and finish schedule.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Vinyl Composition Floor Tile Adhesives: Not more than 50 g/L.

C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by floor covering manufacturer and as follows. Proceed with installation only after substrates pass testing.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

## 3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis unless noted otherwise in drawings.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction unless noted otherwise in drawings.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

## 3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
1. Apply a minimum of 2 coats of sealer by manufacturer, if recommended.

B. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply three coat(s).

C. Cover floor tile until Substantial Completion.

END OF SECTION 096519

# SECTION 096813 - TILE CARPETING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes modular, carpet tile.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Type of installation.
3. Pattern type, location, and direction.
4. Pile direction.

C. Samples: For each exposed product and for each color and texture specified.

### 1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

### 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide product as noted in the drawings and finish schedule.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other

conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

F. Installation Method: As recommended in writing by carpet tile manufacturer.

G. Maintain dye lot integrity. Do not mix dye lots in same area.

H. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

I. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

K. Install pattern parallel to walls and borders.

L. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

M. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

N. Provide extra carpet tiles to the Owner for future use when replacing damaged tiles.

END OF SECTION 096813

# SECTION 096816 - SHEET CARPETING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes tufted and woven carpet.

### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

### 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Seam locations, types, and methods.
4. Pile direction.

C. Samples: For each exposed product and for each color and texture specified.

### 1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warrant: Sample of special warranty.

### 1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

### 1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced Installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.9 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET

A. Products: Subject to compliance with requirements, provide the following:

1. As noted in the drawings and finish schedule.

B. Color: As noted in the drawings and finish schedule.

C. Pattern: As noted in the drawings and finish schedule.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. Use adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Tackless Carpet Stripping: Water-resistant plywood, in strips as required to match cushion thickness and that comply with CRI 104, Section 12.2.

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Preparation: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

E. Installation: Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
2. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for glue-down installation.

F. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

G. Do not bridge building expansion joints with carpet.

H. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

I. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

K. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

L. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

M. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION 096816

# SECTION 097200 - WALL COVERINGS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Vinyl wall covering.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show location and extent of each wall-covering type.

C. Samples: For each type of wall covering and for each color, texture, and pattern required.

D. Maintenance Data: For wall coverings to include in maintenance manuals.

### 1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: As follows, per ASTM E 84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire-Growth Contribution: Textile wall coverings tested according to NFPA 265 and complying with test protocol and criteria in the 2006 IBC.
3. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.

a. Approved mockups may become part of the completed work if undisturbed at time of substantial completion.

### 1.4 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rolls of Wall-Covering Materials: Full-size units equal to 5 percent of amount installed.

PART 2 - PRODUCTS

2.1 WALL COVERINGS

A. General: Provide rolls of each type of wall covering from same print run or dye lot.

2.2 VINYL WALL COVERING

A. Vinyl Wall-Covering Standards: Provide mildew-resistant products complying with the finish specifications.

B. Stain-Resistant Coating: Dupont; Tedlar/Reflon.

C. Colors, Textures, and Patterns: As noted in the drawings and finish schedule.

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application; as recommended in writing by wall-covering manufacturer and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Primer/Sealer: Mildew resistant, complying with requirements in Division 09 Section "Interior Painting" and recommended in writing by wall-covering manufacturer for intended substrate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Check Painted Surfaces for pigment bleeding. Sand gloss, semi-gloss, and eggshell finishes with fine sandpaper.

B. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

C. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

D. Install wall liner, with no gaps or overlaps, where required by wall-covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

E. Cut wall-covering strips in roll number sequence. Change roll numbers at partition breaks and corners.

F. Install wall covering with no gaps or overlaps, no lifted or curling edges, and no visible shrinkage.

G. Match pattern 72 inches (1830 mm) above the finish floor.

H. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 6 inches (150 mm) from inside corners unless a change of pattern or color exists at corner. No horizontal seams are permitted.

I. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

J. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without any overlay or spacing between strips.

END OF SECTION 097200

# SECTION 099113 - EXTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Galvanized metal.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

D. Exterior Painting Schedule.

### 1.3 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
3. All field applied materials to comply with VOC limits set by state or local municipality having jurisdiction.

B. Colors: As noted in the drawings and finish schedule.

2.2 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

1. VOC Content: E Range of E2.

2.3 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E1.

C. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

D. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1].

E. Quick-Drying Primer for Aluminum: MPI #95.

## 2.4 EXTERIOR LATEX PAINTS

A. Exterior Latex (Flat): MPI #10 (Gloss Level 1).

1. VOC Content: E Range of E1.

B. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

1. VOC Content: E Range of E1

## 2.5 EXTERIOR ALKYD PAINTS

A. Exterior Alkyd Enamel (Flat): MPI #8 (Gloss Level 1).

1. VOC Content: E Range of E1.

B. Exterior Alkyd Enamel (Semigloss): MPI #94 (Gloss Level 5).

1. VOC Content: E Range of E1.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

## 3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.3 EXTERIOR PAINTING SCHEDULE – To be Completed by Painting Contractor.

A. CMU Substrates:

1. Latex System: MPI EXT 4.2A.

a. Prime Coat: Interior/exterior latex block filler.
b. Intermediate Coat: Exterior latex matching topcoat.
c. Topcoat: Exterior latex (flat).

B. Steel Substrates:

1. Quick-Drying Enamel System: MPI EXT 5.1A.

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Quick-drying enamel matching topcoat.
c. Topcoat: Quick-drying enamel (semigloss).

2. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (semigloss).

C. Galvanized-Metal Substrates:

1. Latex System: MPI EXT 5.3A.

    a. Prime Coat: Cementitious galvanized-metal primer.
    b. Intermediate Coat: Exterior latex matching topcoat.
    c. Topcoat: Exterior latex (semigloss).

2. Alkyd System: MPI EXT 5.3B.

    a. Prime Coat: Cementitious galvanized-metal primer.
    b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    c. Topcoat: Exterior alkyd enamel (semigloss).

END OF SECTION 099113

# SECTION 099123 - INTERIOR PAINTING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Steel.
3. Galvanized metal.
4. Wood.
5. Gypsum board.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

D. Interior painting schedule.

### 1.3 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.

3. Final approval of color selections will be based on benchmark samples.

    a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

## 1.4 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

# PART 2 - PRODUCTS

## 2.1 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop.

C. All field applied materials to comply with VOC limits set by state or local municipality having jurisdiction.

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
4. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.

g. Di (2-ethylhexyl) phthalate.
h. Di-n-butyl phthalate.
i. Di-n-octyl phthalate.
j. 1,2-dichlorobenzene.
k. Diethyl phthalate.
l. Dimethyl phthalate.
m. Ethylbenzene.
n. Formaldehyde.
o. Hexavalent chromium.
p. Isophorone.
q. Lead.
r. Mercury.
s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

D. Colors: As noted in the drawings and finish schedule.

## 2.2 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

1. VOC Content: E Range of E3.

## 2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: EPR 1.

B. Interior Alkyd Primer/Sealer: MPI #45.

1. VOC Content: E Range of E1.

## 2.4 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E1.

C. Rust-Inhibitive Primer (Water Based): MPI #107.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

D. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

E. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

F. Vinyl Wash Primer: MPI #80.

1. VOC Content: E Range of E2.

G. Quick-Drying Primer for Aluminum: MPI #95.

1. VOC Content: E Range of E1.

2.5 WOOD PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

2.6 PAINTS – See Finish Plan

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: EPR 0.5.

B. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

C. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

1. VOC Content: E Range of E1
2. Environmental Performance Rating: EPR 2.

2.7 ALKYD PAINTS

A. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).

1. VOC Content: E Range of E1.

B. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).

1. VOC Content: E Range of E1.

C. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 1.

## 2.8 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

1. VOC Content: E Range of E1.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

## 3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Mechanical and Electrical Work: Paint items exposed in occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

a. Switchgear.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE – To be submitted by painting Contractor.

END OF SECTION 099123

# SECTION 101400 - SIGNAGE

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes the following:

1. Signage required by current building codes and authorities have jurisdiction.
2. Custom signage by others.

### 1.2 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each sign type and for each color and texture required.

### 1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

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.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Custom designed and/or provided by others. Not in General Contractor contract.

B. General Contractor to provide a list of signs required by current building codes and authorities having jurisdiction. Submit shop drawings to Architect for review prior to install.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Contractor to install signage required by applicable building codes. When required, General Contractor to provide blocking and power at signage locations.

END OF SECTION 101400

# SECTION 10 1453 - TRAFFIC SIGNAGE

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Traffic signage; as indicated on the Drawings, specified herein, including related accessories and attachments.

### 1.2 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify actual locations of traffic signage and other construction to which traffic signage must fit by accurate field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delay of Work.

### 1.3 SUBMITTALS

A. Submit under provisions of Division One Specifications.

B. Product Data: Submit manufacturer's data on product characteristics, accessories, hardware, finishes, and installation instructions.

C. Samples: Submit samples of product colors including finish and texture.

### 1.4 DELIVERY, STORAGE, AND PROTECTION

A. Deliver, store, handle and protect products to the site under provisions of Division One Specifications.

B. Deliver and store products to site in accordance with manufacturer's instructions.

C. Protect products from weather and construction operations.

## 1.5 WARRANTY

A. Provide manufacturer's written warranty under provisions of Division One Specifications.

B. Warranty: All materials and workmanship provided are guaranteed against defects after completion and final acceptance of the Work. Defects due to faulty materials or workmanship developed during the guarantee period shall be satisfactorily repaired or replaced at no expense to the Owner.

# PART 2 EXECUTION

## 2.1 EXAMINATION

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

## 2.2 TRAFFIC SIGNAGE INSTALLATION

A. Install site traffic signage in accordance with manufacturer's instructions.

B. Install traffic signage at all locations indicated on the Drawings under the direction of the Architect.

C. Accessible parking signage shall be installed to the proper height in accordance with applicable state building code and ADA standards.

## 2.3 CLEANING

A. Dispose of excess materials and debris from the job-site.

B. Prior to Substantial Completion, clean all exposed surfaces in accordance with manufacturer's instructions.

END OF SECTION

# SECTION 102600 - WALL AND DOOR PROTECTION

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Corner guards.

### 1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
2. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
3. Uniform and concentrated loads need not be assumed to act concurrently.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture.

D. Material test reports.

E. Maintenance data.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Surface-Burning Characteristics: As determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

C. Preinstallation Conference: Conduct conference at Project site.

### 1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

### 2.2 CORNER GUARDS

A. Surface-Mounted, Corner Guards as noted on floor plans or elevations: Fabricated with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: As noted in the drawings and finish schedule.

a. C/S Group.

b. IPC Door and Wall Protection Systems; Division of InPro Corporation.
c. Pawling Corporation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

B. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

END OF SECTION 102600

# SECTION 102800 – TOILET ACCESSORIES

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Bathrooms and washroom accessories.
2. Childcare accessories.
3. Underlavatory guards.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

C. Maintenance data.

D. Warranty: Sample of special warranty.

### 1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 1.4 WARRANTY

A. Special Mirror Warranty Manufacturer’s standard form in which manufacturer agrees to replace mirrors that develop visible silve spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BATHROOM AND WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product as indicated on the drawings and finish schedule.

2.2 CHILDCARE ACCESSORIES

A. Diaper-Changing Station:

1. Basis-of-Design Product: as indicated on the drawings and finish schedule.

2.3 UNDERLAVATORY GUARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

3. a. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
b. Material and Finish: Antimicrobial, molded plastic, white.

2.4 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

END OF SECTION 102800

# SECTION 104413 - FIRE EXTINGUISHER CABINETS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes fire protection cabinets for fire extinguishers.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified.

D. Maintenance data.

### 1.3 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 1.5 mm thick, with Finish 1 polished.

### 2.2 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: as indicated on the drawings or comparable product from one of the following manufacturers:

a. J. L. Industries, Inc.
b. Larsen's Manufacturing Company.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Steel sheet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. 1-1/2-inch Square-Edge Trim.

E. Door Material: Steel sheet.

F. Door Style: Fully glazed panel with frame.

G. Door Glazing: Acrylic sheet.

1. Acrylic Sheet Color: Clear transparent acrylic sheet.

H. Door Hardware: Manufacturer’s standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

I. Accessories:

1. Mounting Bracket: Manufacturer’s standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for lettering style, size, spacing, and location. Locate as directed by Architect.

J. Finishes:

1. Steel: Stainless.

## 2.3 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer’s standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Mite and weld joints and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.

B. Install fire protection cabinets in locations and at mounting heights indicated 54” AFF to top of cabinet

C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply vinyl lettering at locations indicated if required by authorities having jurisdiction.

E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

# SECTION 104416 - FIRE EXTINGUISHERS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

### 1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Remaining paragraphs are defined in Division 01 Section "Submittal Procedures" as "Informational Submittals."Operation and maintenance data.

C. Warranty: Sample of special warranty.

### 1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

### 1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. J. L. Industries, Inc.; a division of Activar Construction Products Group.
b. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
c. Larsen's Manufacturing Company.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated at 2A – 10BC nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

**DIVISION 13**

**SWIMMING POOLS**

**SECTION 13 11 10**

POOL GENERAL PROVISIONS

**SECTION 13 11 40**

POOL PIPE, FITTINGS & VALVES

**SECTION 13 11 41**

POOL STRUCTURE

**SECTION 13 11 44**

POOL CHEMICAL EQUIPMENT

**SECTION 13 11 46**

POOL FEATURES AND EQUIPMENT

**SECTION 13 11 47**

POOL SIGNAGE

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**SECTION 13 11 10**

**POOL GENERAL PROVISIONS**

## PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary conditions and Division 1 Specifications, apply to this section.

1. Related Sections:

| | |
|---|---|
| Section 13 11 40 | POOL PIPE, FITTINGS & VALVES |
| Section 13 11 41 | POOL STRUCTURE |
| Section 13 11 44 | POOL CHEMICAL EQUIPMENT |
| Section 13 11 46 | POOL FEATURES AND EQUIPMENT |
| Section 13 11 47 | POOL SIGNAGE |

B. Published specifications, standards, tests, or recommended methods of trade, industry, environmental organizations and applicable code apply to work of this section.

1.02 GENERAL

A. The Contractor shall furnish all materials, equipment and labor required to construct all mechanical elements of the swimming pool part of the project, including all yard and Mechanical Room pool piping, chemical feeders, etc.

B. Contractor doing work in this Sections 13 11 10 to 13 11 47 must have at least 5 years of experience in similar construction and must submit a list of five (5) operating pools similar to this project completed by the contractor in the last 5 years.

C. Contractor doing work in Sections 13 11 10 to 13 11 47 must be pre-approval with local authority requirements and be prepared to submit the engineered drawings and required cut sheets if awarded the project.

1.03 SUMMARY

A. This division of the specifications is intended to describe the construction of the pool and all related appurtenances. Only contractors capable of meeting the qualifications and furnishing all the work called for shall be considered. All work called for in this division shall be, and remain through the warranty periods, the responsibility of this contractor. This includes complete pool construction and in exact accordance with plans and specifications, including (but not limited to):pool structures, pool finish, accents, filtration system, pool heater, chemical feed system, recirculation system, deck equipment and miscellaneous pool equipment as specified.

1.04 SUMMARY OF WORK

A. Work by Owner/Other Sub-Contractor

1. Per plans

B. Work by Pool Contractor

1. All work within the boundaries of the pool area, with the exception of mechanical (not relating to pool) and electrical work. As contained in this specification, SP Drawings.
2. Layout pool with bench marks and exact location supplied by the plans and specifications.
3. Dewatering of pool excavation for ground water.
4. Provide and install all required forms for pool construction and remove after use.
5. Furnish and install hydrostatic relief system at deep end of the swimming pool structure.
6. Provide and install required reinforcing steel for pool structure.
7. Construct shotcrete pool structures in accordance with the plans.
8. Provide and install complete pool filtration and circulation system.

9. Provide and install entire recirculation systems for pool and Schedule 40 PVC piping between pool and equipment room.
10. Furnish and install ceramic tile accent striping and waterline tile.
11. Furnish and install Diamond Brite pool finish with required ceramic tile border.
12. Provide and install the integrated disinfection/control system including disinfectant, pH adjustment, and ORP/pH control as specified.
13. Furnish and install depth markings and “NO DIVING” tile in deck.
14. Furnish and install all deck equipment and accessory equipment anchors shown and/or specified in this proposal. Coordinate all deck equipment and anchor installation with the Concrete Deck Contractor. Installation in or on the pool deck or elsewhere shall also be a part of the pool Contractor’s work.
15. Provide all testing, cleaning and safety equipment.
16. Provide instruction manuals and/or operation charts for equipment replaced.
17. Provide startup supervision upon project’s completion and two follow up visits within the first month of operation.
18. Maintain a superintendent or foreman on the job when pool construction work is performed and when required for coordination with other contractors. Superintendent and foreman shall be familiar with the contract’s documents and shall employ qualified and experienced mechanics of proper trades.
19. Provide complete shop drawings for pool’s mechanical construction and related equipment to Engineer for approval.
20. Take all measurements for pool and pool’s mechanical construction and be responsible for same. Coordinate the pool work shop drawings with all other contractors affected.
21. Perform training sessions for the owner in all aspects of the pools operation, including, but not limited to, recirculation, disinfection, filtration, heating and winterization or draining. The owner must have had a complete introduction to their aquatic operations. Documentation of training is required.
22. Protect all work materials, fixtures and equipment from damage. Deliver all work to the owner clean and in perfect working condition. Keep work areas clean of debris and promptly remove waste materials from the premises.
23. The Pool Contractor is responsible for all pool work until accepted by the Owner. Acceptance of pool must correspond with agreed completion date stated.
24. Upon completion of the project and acceptance by Owner, the Pool Contractor to provide the Owner with a one (1) year full warranty on the pool shell and cover all pool equipment manufacturer’s warranties based on the date of acceptance.

C. Work by Others

1. Grounding of pool structure and related appurtenances.
2. Concrete deck, trench drains & piping, area drains & piping, fencing.
3. Site access for heavy equipment.
4. All general, mechanical, electrical construction work not included in pool work.
5. Construction and backfill of all equipment room construction, including foundations, floor and walls, footings, and sumps, as required for pool mechanical room work.
6. All electrical for pool mechanical equipment. Electrical as shown on the drawings, including low voltage connections required for complete installation of chemical feed equipment (controller, chemical feeders, booster pump relays)
7. Soil tests or soil engineering for pool placement and construction.
8. Furnish any water, power, or other utility necessary to complete the said Swimming Pool available to the said location for the use of the Pool Contractor.
9. Furnish the electrical line from the available electrical service to the equipment room.
10. Furnish the potable water line from the available water service to the equipment room.
11. Furnish the gas line from the available gas service to equipment room.
12. Furnish and install waste receptacle for filter backwash with waste line to proper discharge.
13. Furnish and install heater venting.
14. Sodding and/or seeding of landscape areas.

1.05 CODES AND STANDARDS

A. All work shall conform to the latest editions of the following codes:

1. State Building Code
2. City/County/State Swimming Pool Code
3. Underwriters Laboratories (UL)
4. National Fire Protection Association (NFPA)
5. Plumbing code
6. SMACNA
7. ASHRAE

1.06 PERMITS AND FEES

A. The Contractor shall acquire all permits and approvals required for installation of the pool and pool equipment. The contractor must also arrange for inspections as required by governing agencies and obtain required certificates of inspection. Contractor shall pay all sales taxes, fees, permits and other costs pertaining to the installation of swimming pool equipment.

1.07 DISCREPANCIES; AMBIGUITIES; OMISSIONS

A. No oral interpretation will be made of the specifications or the drawings. Notify the Design Professional immediately if discrepancies or ambiguities in or omissions from the drawings and specifications are found. In the case of a discrepancy, the option which is more beneficial to the owner shall be used.

B. Interpretations of the documents will be made only in form of an addendum. Addenda shall become a part of the contract documents.

1.08 SHOP DRAWINGS

A. Submit shop drawings for all equipment in accord with General Requirements.

B. All tank, vessel and structural shops to be signed by a structural engineer registered in the project location.

1.09 DRAWINGS

A. Field measurements of existing objects shall take precedence over the information on the drawings. Any alteration of the plan described on the drawings due to a different field location shall be done in consultation with the Design Professional or his representative.

1.10 CUTTING AND PATCHING

A. Saw cut and or core drill all floor, wall openings not provided.

B. All penetrations must be properly sealed in accordance with specifications.

1.11 EQUIPMENT ERECTION

A. The Contractor shall install all equipment with best construction practices and in accordance with the manufacturer’s instructions and recommendations.

1.12 TESTS

A. The Contractor shall pay for all tests required and will provide all materials necessary to perform tests.

B. All piping shall prove absolutely tight under required tests. Make tests before pipe is covered or connected to equipment.

C. Remedy all defects found as result of testing. Repair, then repeat test as necessarily until results are acceptable.

1.13 RECORD DRAWINGS

A. Prepare clear and accurate drawings or sketches showing as-built installation of piping, fixtures and equipment. Show any differences from original plans. Submit as-built drawing to the Design Professional and Owner at completion of work.

1.14 ACCEPTANCE OF WORK

A. Acceptance shall follow the requirements of the General Conditions. When specified work is completed, the Design Professional, Owner and Contractor will conduct a detailed tour of work area prior to submitting formal acceptance of work completed. Complete conformance with the specifications in every detail is a condition precedent to the acceptance of the work by the Owner. The pool shall be a complete operating pool system with all mechanical equipment as specified in the project documents in place and operating before the Owner and the Design Professional will accept the work as complete.

1.15 MAINTENANCE AND OPERATING INSTRUCTIONS

A. Submit two bound copies of maintenance and operating instructions for all equipment and instruct the Owner's representative on the proper use and maintenance of the new system and equipment. Manuals must include:

1. Valve legend and valve settings for pool operation procedures.
2. Pool draining and filling instructions.
3. Pool equipment shop drawing/submittal information with operating and maintenance procedures and product representatives contact name and numbers.
4. Equipment warrantee information.
5. Information on cleaning requirements of stainless steel components.
6. As-built drawings.

1.16 WARRANTIES

A. The Contractor shall guarantee all workmanship and material against defects for at least one year from the date of acceptance.

1.17 START-UP

A. The Contractor is responsible for start-up of system and balancing of flow rates.

B. Water chemistry to be balanced by Contractor.

C. All chemicals to be supplied by Owner from recommendation by Design Professional and Contractor.

D. Water balance must include consideration of saturation index, disinfectant level, pH, calcium hardness, alkalinity and all required levels as dictated by State Pool Code.

E. The contractor or their designees, as agreed upon by the Owner, must be on site for up to 4 hours per day, the day preceding grand opening, the day of grand opening, and the day following grand opening. The purpose of the on-site person is to assist the owner in maintaining the pools and related systems under full load and to ensure that staff is managing all equipment per the operations guidelines.

F. The contractor or their designees, as agreed upon by the Owner, must be on site for up to 4 hours per day, the day preceding second season opening, the day of second season opening, and the day following second season opening. The purpose of the on-site person is to assist the owner in maintaining the pools and related systems under full load and to ensure that staff is managing all equipment per the operations guidelines.

1.18 POOL DRAINAGE / WINTERIZING

A. All drainage lines for winterizing or maintenance of the pool (s) must terminate with a 2-inch PVC ball valve with defined path to waste.

B. Contractor must be present at first draining / winterizing of the pools to supply required information.

C. Instruction Manual must include drainage instructions.

**PART 2 - PRODUCTS**

2.01 GENERAL

A. See plans for individual pool data and equipment listing.

B. Product manufacturers and model numbers are listed to set a level of quality for each item specified. If using alternate manufacturers, it is the responsibility of bidding contractor to meet or exceed specified equipment. The Design Professional shall be sole judge of whether equipment submitted meets or exceeds specified equipment.

C. All products are to be suitable for high corrosive environments, constructed of nonferrous materials or otherwise protected from rust/corrosion and approved for use in a pool mechanical room by the manufacturer or the Design Professional.

## PART 3 - EXECUTION

3.01 GENERAL

A. The contractor shall install all equipment and structures with best construction practices and in accordance with the manufacturer's instructions and recommendations and in accordance with all local and state codes.

B. All flanges, bolts, nuts, gaskets or any part in contact with water must be stainless steel or non-metallic unless otherwise specified.

1. All other mounting hardware, flanges, bolts, nuts, materials, etc. are to be stainless steel. Where stainless steel products are not reasonably available, products must be galvanized or otherwise protected from rust/corrosion.

**END OF SECTION**

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**SECTION 13 11 40**

**POOL PIPE, FITTINGS & VALVES**

## PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary conditions, Division 1 and Section 13 11 10, apply to this section.

B. Published specifications, standards, tests, or recommended methods of trade, industry, environmental organizations and applicable code apply to work of this section.

1.02 GENERAL

A. Furnish all labor and material necessary to complete all excavation of pool, pipe trenches and related appurtenances.

B. Furnish all labor and material necessary to complete all backfill of pool walls, pipe trenches and related appurtenances.

C. The Contractor shall furnish materials, equipment and labor to furnish, install and test the piping as described on the drawings and as herein specified.

D. The Contractor shall furnish materials, equipment and labor to furnish, install and test the valves as part of the piping system as described on the drawings and as herein specified.

1.03 SUMMARY

A. This section of the specifications is intended to describe pool excavation, piping, valves and all related appurtenances.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Valves 3" and larger shall be wafer style for ANSI flanges with lever operators to 6". 8" and larger to be gear operated. Bodies and discs to be P.V.C. Seats and seals to be EPDM. Contractor is cautioned to verify proper sizing to avoid restriction of flow through valves.

B. All fittings to be molded; fabricated fittings are not permitted.

2.02 GRANULAR BEDDING MATERIAL

A. The aggregate bedding material placed under pool floor and around piping shall meet the following gradation requirements:

| Sieve Size | Percent Passing |
|---|---|
| 25.0 mm (1 inch) | 100 |
| 19.0 mm (3/4 inch) | 90-100 |
| 9.5 mm (3/8 inch) | 50-95 |
| 4.75 mm (#4) | 35-85 |
| 2.00 mm (#10) | 20-65 |
| 425 um (#40) | 10-35 |
| 75 um (#200) | 3-10 |

2.03 INTERCONNECTING PIPE FROM FILTER SYSTEMS TO POOL

A. All piping connecting the filter system to the pool recirculation system shall be schedule 40 rigid P.V.C. pipe solvent weld bell with schedule 40 P.V.C. solvent weld fitting which conform to the requirements of ASTM D1785, Type 1 - Schedule 40. All connections to filter or recirculation system 2-1/2" and under in size shall be threaded connections. All connections to filter or recirculation

system 3" and over in size shall be flanged connections. Any and all piping carrying water in excess of 110 degrees Fahrenheit shall be C.P.V.C., in excess of 140 degrees Fahrenheit shall be hard copper. The same shall be true for fittings. Piping shall be installed in accordance with the latest ASTM Publication for Specified Pipe. (PVC: requirements of ASTM D1784 and ASTM D1785-Schedule 40; CPVC: requirements of ASTM D-1784 and F-441)

2.04 SUPPORTS AND HANGERS

A. Supports and hangers can be clamp, saddle angle, spring or other standard type. Broad, smooth bearing surfaces are better than narrow or sharp contact, since they minimize danger of stress concentration and physical damage. All mountings and anchors shall be non-corrosive material.

B. Pipe runs in the equipment room shall be supported on Unistrut installed from wall to wall across width of equipment room. Bottom of Unistrut to be minimum 7'-6" feet above finished floor. Unistrut to be sized and installed per manufacturer requirements for span and load. Unistrut spacing per spacing requirements for PVC pipe as given in table in this section. Coordinate with general contractor. Coordinate with electrical contractor for lighting installation

C. Supports generally should not clamp pipe and prevent end wise movement needed to allow for thermal expansion. Rigid clamping is advisable at values and fittings located near sharp changes in direction when line is subjected to wide temperature changes. With exception of coupling, all plastic fittings shall be supported individually and valves shall be braced against operating torque. Generally, vertical runs are supported by spring hangers and guided with ring or U-bolts, which restrict movement of rise to one plane. See support spacing chart that follows:

SUPPORT SPACING FOR PVC PIPE (IN FEET)

| Nominal pipe size (inches) | Schedule 40 | | | Schedule 80 | | |
|---|---|---|---|---|---|---|
| | 60° F | 100° F | 140° F | 60° F | 100° F | 140° F |
| ½ | 4 ½ | 4 | 2 ½ | 5 | 4 ½ | 2 ½ |
| ¾ | 5 | 4 | 2 ½ | 5 ½ | 4 ½ | 2 ½ |
| 1 | 5 ½ | 4 ½ | 2 ½ | 6 | 5 | 3 |
| 1 ½ | 6 | 5 | 3 | 6 ½ | 5 ½ | 3 ½ |
| 2 | 6 | 5 | 3 | 7 | 6 | 3 ½ |
| 3 | 7 | 6 | 3 ½ | 8 | 7 | 4 |
| 4 | 7 ½ | 6 ½ | 4 | 9 | 7 ½ | 4 ½ |
| 6 | 8 ½ | 7 ½ | 4 ½ | 10 | 9 | 5 |
| 8 | 9 | 8 | 4 ½ | 11 | 9 ½ | 5 ½ |
| 10 | 10 | 8 ½ | 5 | 12 | 10 | 6 |

2.05 BUTTERFLY VALVES

A. All Butterfly Valves shall be wafer style. All solid thermoplastic butterfly valves shall be of the lined body design and seal bubble tight with only the liner and disc as wetted parts. The disc shall have double"O" ring seals on top and bottom trunnions of the same material as the valve liner. Liner shall be molded and formed around the body, functioning as a gasket on each side of valve. Stem shall be of stainless steel and have engagement over the full length of the disc.

B. Valve operators shall be either of the hand wheel of hand lever type as indicated on the drawings. These manual operators shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical stop-limiting devices to prevent over travel of the disc in the open and closed positions. Valves shall close with a clockwise rotation. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 lb. on the hand wheel. Operator components shall withstand an input of 300 ft. Lbs. at extreme operator position without damage. Valves less than

8" diameter shall be lever operated. Valves greater than or equal to 8" diameter shall be gear operated.

C. Valve position indicators shall be provided on all butterfly valves.

2.06 CHECK VALVES

A. Check Valve shall be swing style, flangeless and with spring assisted closure. Valve shall be designed to be installed between ANSI 123#/1150# flanges with a P.V.C. body, one piece disc and disc arm; 316SS shaft, shaft bushings and spring; a Buna-N seat mounted in the body. The valve shall comply with performance standards of AWWA C-508.

B. Check valves three (3) inch and larger shall be wafer style. Bodies and discs to be P.V.C. Seats and seals to be EPDM.

C. Check valves two and one-half (2 ½) inches and smaller shall be socket true union. Socket and threaded bodies to be P.V.C. or C.P.V.C. Seats and seals to be EPDM.

2.07 BALL VALVES

A. Ball valves two and one-half (2 ½) inches and smaller shall be socket true union. Socket and threaded bodies to be P.V.C. or C.P.V.C. Seats and seals to be EPDM.

2.08 GATE VALVES

A. Gate valves two and one-half (2 ½) inches and smaller - brass body with rising stem and suitable for 125# S.W.P. threaded ends. Valves must be true union.

2.09 VALVES FOR HEATERS

A. Valves for heater bypass, connected to copper piping, must be brass valves.

2.10 WATER LEVEL CONTROL VALVE

A. The water level control valve shall be as specified in the equipment list and installed per manufacturers requirements.

**PART 3 - EXECUTION**

3.01 GENERAL

A. The contractor shall install all piping, fittings, valves and related appurtenances with best construction practices and in accordance with the manufacturer's instructions and recommendations and in accordance with all local and state codes.

3.02 PIPING TRENCH

A. Trench Excavation

1. The Contractor shall dig the trench to the alignment and depth shown on the plans. The trench shall be sufficiently straight to permit the pipe to be laid true to line in the approximate location of the trench as indicated on the drawings.
2. The Contractor shall excavate, brace, sheet and drain the trench so that workmen may work safely and efficiently therein as required by OSHA Regulations.
3. The Contractor shall discharge dewatering pumps to the natural drainage channels.
4. The trench width may vary and will depend upon the depth the trench, the diameter and number of pipes to be laid and the nature of the material to be excavated. Trench widths, side slopes and trench bracing and sheeting shall conform to the regulations of OSHA and the appropriate state agency.
5. The sides of the trench shall be as nearly vertical as practical below a point one foot above the top of the pipe.

B. Preparation of trench bottom

1. The trench shall not have standing water when trench bottom is prepared or when pipe is laid.

2. Excavate bell or flange holes if so required, so that after placement only the barrel of the pipe receives bearing pressure from the trench bottom, and the pipe is true to line and grade.

C. Pipe laying

1. Pipe shall be carefully lowered into trench piece by piece in such a manner as to prevent damage to materials and protective coatings. Under no circumstances shall pipe materials be dumped into the trench.
2. Before lowering and while suspended, inspect the pipe for defects and coating damage. Any defective, damaged, or unsound pipe shall be rejected and removed from the site.
3. Remove all foreign matter or dirt from the inside of the pipe before it is lowered into its position in the trench, and keep the pipe clean by approved means during and after laying.
4. Bed every pipe uniformly throughout its entire length.

D. Backfill at pipe zone

1. Place Granular Bedding Material in the trench simultaneously on both sides of the pipe for the full width of the trench in six (6) inch lifts to a point one half the pipe diameter above the invert.
2. Place Granular Backfill Material in the trench from the mid height of the pipe to a point 12" above the pipe.
3. Compact bedding and backfill materials using vibrating or other mechanical equipment suitable for the soils encountered, to a density equal or greater than 100%, or as stated below, of the maximum density as measured by the Standard Proctor Test ASTM Designation D-698.
4. The pipe zone extends from the bottom of the trench to a point 12 inches above the top of the pipe.
5. The Design Professional may require backfill in the pipe zone to be placed by hand if the pipe is disturbed by backfill operations or if the backfill material is not properly compacted.

E. Trench backfill

1. Backfill the trench above the pipe zone with trench excavated material. The backfill shall be placed in lifts, not to exceed one foot in compaction thickness. Compact each lift using vibrating or other mechanical equipment suitable for the soils encountered, to a density equal or greater than 100% of the maximum density as measured by the Standard Proctor Test ASTM Designation D-698.
2. Tests to determine the compacted density of the backfill shall be ordered by the Design Professional if in the Design Professionals' opinion the compaction is not adequate.
3. All excess material shall be hauled by the Contractor to a disposal area as directed by Construction Manager.

3.03 PIPING

A. Testing of pipe connecting the filter systems to the pool circulating system shall be as follows:

1. All testing shall be done with water under pressure.
2. All piping under pressure shall be tested at 35 PSI for one full hour without any significant drop in pressure.
3. All piping under vacuum or gravity flow shall be tested at 35 PSI for one full hour without any significant drop in pressure.
4. If piping fails test, the Contractor will repair or replace pipe at his own expense.
5. If piping passes test, this does not release the Contractor of his responsibility to guarantee piping against materials and/or workmanship during warranty period.

B. Piping must be properly labeled and marked in accordance with these specifications and all local and state codes. Piping must be marked by label, color code, tag, or other distinguishing marking (permanent marker is not acceptable):

a. for direction of flow; and
b. for identifying pool, feature, or amenity served.

3.04 GLUE

A. The glue used for connecting PVC and CPVC pipe shall be clear in color at all locations where the pipe is visible. Pipe installed in non-visible locations may be connected with colored glue.

B. Glue as manufactured by IPS, cement No. 717 (clear) or equal. (Up to 12" Schedule 80)

C. Primer as manufactured by IPS, primer No. P70C (clear) or equal.

3.05 VALVES

A. The contractor shall install all valves with best construction practices and in accordance with the manufacturer's instructions and recommendations. All flanges, bolts, nuts, riser handles and gaskets must be non-corrosive, stainless steel or non-metallic unless otherwise specified.

B. Valves must be number tagged and identified in operation manual and wall chart.

**END OF SECTION**

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**SECTION 13 11 41**

**POOL STRUCTURE**

## PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary conditions, Division 1 and Section 13 11 10, apply to this section.

B. Published specifications, standards, tests, or recommended methods of trade, industry, environmental organizations and applicable code apply to work of this section.

1.02 GENERAL

A. Furnish and apply all forms required for the placement of cast-in-place concrete and grout.

B. Furnish and install concrete reinforcement as shown on the plans and specified herein.

C. The work in this section includes providing all supervision, materials, labor equipment and related services necessary to furnish and install all shotcrete material indicated on the drawings.

D. The required applications of sealants include all sealants shown and required for weather tight construction.

1.03 STANDARDS

A. FORMWORK: Conform to the following standards:

1. ACI-347-68. “Recommended Practice for Concrete Formwork”
2. ACI-301-89, “Specifications for Structural Concrete for Buildings”

B. REINFORCING: Conform to the latest editions of the following standards as set forth by the following publications of the American Concrete Institute and Concrete Reinforcing Institute:

1. ACI-318 “Building Code Requirements for Reinforced Concrete.”
2. ACI-315 “Manual of Standard Practice for Detailing Reinforced Concrete Structures.”
3. CRSI Design Handbook.

C. SHOTCRETE: The work shall conform to the latest editions of the following standards /specifications unless otherwise noted:

1. ACI 117, “Standard Tolerances for Concrete Construction and Materials”
2. ACI 301, “Specifications for Structural Concrete for Buildings”
3. ACI 305R, “Hot Weather Concreting”
4. ACI 306R, “Cold Weather Concreting”
5. ACI 318, “Building Code Requirements for Reinforced Concrete”
6. ACI 347, “Recommended Practice for Concrete Formwork”
7. ACI 506R, “Guide to Shotcrete”
8. ACI 506.2, “Specification for Materials, Proportioning and Application of Shotcrete” (Revised 1983)
9. ACI 506.3, “Guide to Certification of Shotcrete Nozzleman”

1.04 SUMMARY

A. This section of the specifications is intended to describe the pool structure, excavation, formwork, reinforcement, shotcrete, subgrade fill, sealants and all other related appurtenances.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Submit 5 copies of shop drawings/submittals for checking and approval:

1. Reinforcing

2. Shotcrete mix design including:
    a. The proportions and types of all materials.
    b. Fine and coarse aggregate gradations per ASTM C33.
    c. Method of determining the mix design proportions.
    d. Water/cement ratio and slump.
    e. Air content of both plastic and hardened concrete.
    f. Compressive strength at 7 and 28 days per ASTM C39.
    g. Nozzleman's ACI certification or resume of past project history demonstrating successful experience on projects of comparable size and scope as to that of the proposed work.
3. Sealants including:
    a. Manufacturer's specifications.
    b. Manufacturer's recommendations.
    c. Installation instructions.

2.02 GRANULAR BACKFILL MATERIAL

A. All subgrade stabilizing aggregate under the pool structure shall meet the following gradation requirements:

| Sieve Size | Percent Passing |
|---|---|
| 25.0 mm (1 inch) | 100 |
| 19.0 mm (3/4 inch) | 90-100 |
| 9.5 mm (3/8 inch) | 50-95 |
| 4.75 mm (#4) | 35-85 |
| 2.00 mm (#10) | 20-70 |
| 425 um (#40) | 10-45 |
| 75 um (#200) | 7-15 |

B. This load bearing fill shall consist of any pit-run or crusher run material that is so graded from coarse to fine that, of the portion passing a one inch sieve, not more than 15 per cent by weight, will pass a No. 200 sieve.

2.03 CONCRETE CONSTRUCTION JOINT SEALANTS

A. Surface Preparation: Surfaces must be clean and dry. Remove all dirt, rocks, rust or other debris. Do not install WATERSTOP-RX in standing water.

B. Must have a three inch (3") concrete cover to exterior concrete surface.

C. Use flat serrated type when little or no joint movement is expected. Approved products:

1. Polyvinylchloride (PVC) Type, Serrated (ribbed), flat or
2. Centerbulb by Greenstreak Plastic Products Co. or
3. Volclay WATERSTOP-RX, Bentonite Strip Waterstop System as produced by Colloid Environmental Technologies Company, Arlington Heights, IL. (with Design Professional's specific application approval) or
4. Approved equal.

2.04 CONCRETE WALL PENETRATION SEALANT

A. Link Seals must be used to seal wall penetrations for piping when core drilling is used.

1. Bentonite strip waterstop (WATERSTOP-RX) at concrete joints or wall penetrations only if approved by the Design Professional for a specific application.

2.05 JOINT CAULK

A. Caulking as shown on the plans at the joint between the stainless steel perimeter and pool wall and/or at construction joints, shall be performed by a contractor experienced in such installations. Material to be:

1. two-part epoxy joint sealant, 940 FCS Dual Tube System by Cobitco/Pressure Patch; or

2. Tremco Vulkem 116 (cure time or painting required);
3. PCI 270 with accelerant; or
4. Ruscoe Permanent Sealer; or
5. Approved equal.

2.06 FORMWORK

A. Board Forms: “Standard” Grade Douglas Fir.

B. Plywood Forms: Exterior fir plywood, EXT-DFPA-AC. Use for all walls which are exposed to view.

C. Form Ties: For exposed work, obtain Design Professional’s approval of type used.

D. Premade contraction joint strips if used for deck construction must not affect the surface slope. Finished slope is expected to be smooth over joint strip insert after removal.

2.07 REINFORCING BARS

A. Reinforcing Bars: ASTM A615 Grade 40

B. Fabricate to dimensions shown on the plans in accordance with requirements of the Concrete Reinforcing Steel Institute. All bars shall be bent cold, unless otherwise permitted by the Design Professional. No bars partially embedded in concrete shall be field bent except as shown on the plans or as specifically permitted by the Design Professional.

2.08 SHOTCRETE

A. Materials:

1. Portland Cement: Type I, ASTM C150 (non air-entrained).
2. Aggregate: Fine aggregate shall conform to ASTM C33 (natural sand) Coarse Aggregate shall conform to ASTM C33, #4 maximum size, class 4S. A combined grading of fine and coarse aggregate should conform to one of the gradings of Table 202b of ACI 506.
3. Water: Mixing water shall conform to ASTM C94.
4. If an admixture is included as part of the mix design submittal, a written explanation of the reason for the admixture must be included with the submittal.
5. Fly Ash is permitted in the shotcrete mix as approved by the Design Professional. Flyash is a recycled product. It’s content by weight shall be submitted for LEED.
6. No chloride, chloride compounds, or materials containing a chloride will be permitted in the mix.

B. Requirements:

1. Shotcrete shall have a minimum compressive strength of 5000 psi at 28 days as measured by ASTM C39 procedures.
2. The maximum water/cement ratio shall be 0.31 for walls and 0.39 for floors.
3. Wet or dry mix process may be used for pool construction.
4. The air content of the hardened shotcrete shall be 6.5+1% when measured in accordance with ASTM C231.
5. Shotcrete shall have a slump no greater than three inches (3") for the walls and four inches (4") for the floors.

C. The mix proportions shall be controlled volumetric or weight batching in accordance with ASTM C685. Batching and mixing equipment shall be capable of proportioning and uniformly dispersing all materials at a rate that will provide adequate production.

2.09 MORTAR BED GUNITE OPTION

A. All cement for gunite shall conform to the requirements of the “Standard Specifications for Portland Cement”, serial designation C-150 of the A.S.T.M. and shall be Type I or II (except where transit mixed cement is to be employed) and shall be delivered to the job site in original packages or bulk tanker and adequately protected from the weather during storage.

B. Gunite sand shall consist of clean, hard, sharp particles, and moisture content shall not exceed 5% and the sand shall be well graded in size within the following limits:

| Passing Through | Percent Passing |
|---|---|
| 3/8” screen | 100 |
| No. 4 mesh sieve | 98-100 |
| No. 8 mesh sieve | 70-95 |
| No. 16 mesh sieve | 60-85 |
| No. 30 mesh sieve | 45-65 |
| No. 50 mesh sieve | 15-35 |
| No. 100 mesh sieve | 0-5 |

C. Proportions shall be one part cement to four parts gunite sand by volume mixed dry for a period of not less than one minute after materials have been added.

D. Hydration shall occur at the nozzle or the cement gun, using just enough water so that no slump shall occur in the gunite.

E. The cement gun shall be equipped with an air pressure gauge and the air pressure at the end of the gun shall not be less than 45 lbs. nor more than 70 lbs. when hose is 200 feet in length or less. Air pressure shall increase 5 lbs. for each additional 50 feet of material hose used, but not more than 300 feet of material hose shall be used unless approved by the Owner and Architect.

F. Water pressure at the nozzle shall be maintained at not less than 15 lbs. greater than the air pressure at the gun.

G. The structural gunite shall be applied against original undisturbed soil thoroughly compacted earth, or suitable forms that will not yield during application of the gunite.

H. Surfaces upon which the gunite is to be applied shall be shot at a right angle to the surface, starting at the bottom and continuing upward. It will be built up in layers of thickness that will not slump, allowing sufficient time between the placing of layers for initial set to take place.

I. All loose fine aggregate or rebound shall be removed from the surface being gunited before placing succeeding layers, and whenever possible, the first layer shall entirely cover the reinforcing steel in order to secure it in its proper position.

J. One gunite test cylinder shall be taken for each 50 yards of gunite placed.

K. Welded wire mesh shall be used for reinforcement when applying thin layers of gunite on a pool shell to reach final finish dimensions. The mesh shall be galvanized hot dipped, welded trimmed construction, 0.08 inch wire, 0.92 inch opening by McNichols Company or equivalent.

2.10 DIAMOND BRITE POOL FINISH

A. Diamond Brite “Exposed Aggregate Finish” as manufactured by Southern Grouts & Mortars, Pompano Beach, FL. Additional work with this product includes lane markers and accent striping; all, as shown on the drawings.

B. The final surface must be of a white color. Any other color must be approved by the Design Professional and all local authorities prior to the purchase of the product.

2.11 TILE

A. Tile: Products manufactured by American Olean Tile Company and Dal Tile are acceptable.

B. Portland Cement, ASTM C-150, Type 1

1. Sand, ASTM C-144
2. Lime, ASTM C-206, Type S or ASTM C-207, Type S
3. Water, Potable

C. Furnish standard grade unglazed ceramic floor tile meeting ANSI 137.1 in 2" x 2" x 1/4" tiles at locations shown on drawing.

D. Furnish custom letters and numbers and standard designations in 6" x 6" tiles at locations shown on the drawings. All tile on the deck must be non-slip. Depth markers must properly represent the water depths where they are located.

E. Custom letters, numbers, and standard designations must be in a dark contrasting color to the pool floor and pool deck. If a color other than black is proposed it must be approved by the Design Professional.

F. Bond coat shall be latex Portland cement mortar in compliance with ANSI A108.5. Color to be consistent with grout.

G. Grouting material shall be premixed, sanded, colored tiles grout in accordance with ANSI A108.10. Color to be selected by Architect.

H. Caulking sealant to be 100% silicone material appropriate for use in the designated building area conforming with Federal Specifications TT-S-0015443.

I. Lane Marker Tile Color: Ceramic tile lane markers are to be black. Submit colors to be approved by Architect/Owner.

**PART 3 - EXECUTION**

3.01 GENERAL

A. Handle and store all products in accordance with manufacturer's instructions.

3.02 SEALANTS

A. Installer: A firm with a minimum of 5 years successful experience in the application of the types of materials required, and who agrees to employ only skilled tradesmen for the Work.

B. Deliver materials in manufacturer's original, dated, unopened containers, plainly marked with the manufacturer's name, type, and color.

C. Clearly indicate the components of multiple-part materials.

D. Comply with sealant manufacturer's printed instructions, except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

1. Clean joint surfaces immediately before installation of sealant. Remove dirt, coating, moisture and other substances which would interfere with bond sealant.

3.03 FORMWORK

A. Construct forms to slopes, lines and dimensions shown, plumb and straight and sufficiently tight to prevent leakage.

B. Brace, shore, and tie to prevent displacement due to weight of liquid concrete together with movement s of workers, material. Use two (2) inch dimensional lumber edge forms for slabs where necessary to obtain straight edges, joints.

C. Form slots, chases, recesses, openings indicated and/or required by other trades. Cooperate in locating sleeves, anchors, nailing blocks, etc.

D. Deflection in form work shall not exceed 1/360 of each component span.

E. Horizontal form joints will not be permitted in beams.

F. Provide 3/4" chamfer on all exposed corners.

G. Set embedded items as required.

H. Keep all board and plywood forms wet previous to placing concrete; wet thoroughly just before placing.

I. Remove forms in manner to insure safety of structure.

1. Thrust block, curb and base forms may be removed in 24 hours. Wall forms may be removed in 48 hours.

3.04 REINFORCING

A. Steel bars for concrete reinforcement shall be of specified size, shape and locations called for in the drawings. Place reinforcement accurately according to the plans and approved shop drawings and secure in position by approved accessories. Minimum clear distance between parallel bars shall be not less than 1-1/2 times the bar diameter or less than 1-1/3 times the normal size of the coarse aggregate, or less than 1".

1. Spacers, chairs, ties, and other devices shall be as necessary for properly placing, spacing, supporting and fastening reinforcement in place.
2. Metal reinforcement shall be accurately positioned and secured against displacement by using annealed iron wire ties or suitable clips at intersections.
3. Vertical reinforcement in all concrete walls shall be spaced its proper distance from the face of forms by means of approved pre-cast mortar or concrete blocks.
    a. The size of the surface of the blocks to be placed adjacent to the forms shall not exceed 2 ½" square and the blocks shall be accurately cast to the thickness required.
    b. A suitable iron tie shall be provided in each block; such wire to be used to anchor the block to the steel in order to avoid displacement.

B. No splices of reinforcement shall be made except as shown on the plans, or as specified, or as authorized by the Design Professional.

C. Welded wire fabric shall have a length of lap of not less than the length of one mesh; Reinforcing bars, lap 36 bar diameters.

D. Reinforcing bars must be tied on at least 50% of all joints.

E. Before placing, thoroughly clean reinforcement of any coating, which would reduce bonding.

F. Do not heat, cut or bend bars without Architect's approval.

G. Do not splice reinforcement at points of maximum stress.

1. Stagger splices in adjacent bars and provide a minimum class "B" fusion splice, unless specifically noted otherwise on drawings.

H. The reinforcing shall be protected by the thickness of concrete indicated on the plans. Where not otherwise shown, concrete coverage over the reinforcement shall 3".

1. All reinforcement installations shall be inspected prior to the placement of shotcrete.

3.05 SHOTCRETE

A. The hardened shotcrete shall conform to the original element boundaries or as otherwise indicated on the drawings. Build in any required anchors or other embedments, and box out for any required openings.

B. Adequate ground wires shall be installed to establish the thickness and surface planes of the shotcrete build-up.

1. Both horizontal and vertical ground wires must be installed to establish the thickness and surface planes of the shotcrete build-up.
2. Both horizontal and vertical ground wires must be installed at corners and offsets not clearly established by form work (at exterior corners of walls, column or beam corners, and other locations). They may also be used as screed guides.
3. Eighteen (18) or twenty (20) gauge hard steel piano wire shall be used.
4. Ground wires should be tight and true to line, and placed in such a manner that they may be further tightened.

C. Where shotcrete is to be placed against earth surfaces, such surfaces shall first be thoroughly compacted and trimmed to line and grade. Shotcrete shall not be placed on any surface which is frozen, spongy, or wherever there is free water. The surface shall be kept damp for several hours before applying shotcrete.

D. Where a layer of shotcrete is to be covered by a succeeding layer, it shall first be allowed to take its initial set.

1. All laitance, loose material and rebound shall be removed by brooming.
2. Any laitance which has been allowed to take final set shall be removed by sand blasting and the surface cleaned with an air-water jet.
3. The surface shall be thoroughly sounded with a hammer for drummy areas resulting from rebound pockets or lack of bond. Drummy area, sags or other defects shall be carefully cut out and replaced with the succeeding layer.
4. Surfaces to be shot should be damp.

E. Surfaces which do not receive shotcrete, such as wood framing, shall be protected with waterproof or other adequate means. Adjacent structures or grounds which would be damaged by dust and rebound shall also be protected.

F. When placing shotcrete material:

1. Keep the granular base surface damp prior to shotcreting. Do not place shotcrete against surface that is frozen, spongy, or where there is free water.
2. Do not place shotcrete if the temperature of adjacent concrete is below 40 degrees F. Or above 85 degrees F., unless cold or hot weather concreting procedures are followed according to ACI 305R and 306R.
3. Control application thickness, air pressure and/or water content of the shotcrete to prevent sagging and/or debonding of successive layers.
4. The application nozzle shall be held as at such a distance and angle to facilitate placement of the shotcrete behind reinforcement prior to accumulation on the face of the reinforcement.
5. All reinforcement should be clear and free from scale, loose rust, soil, oil or other coatings that interfere with bonding.
6. Remove all overspray or rebound before final set and shotcreting adjacent surfaces. Do not use rebound or overspray material in the shotcrete mix.
7. Contractor shall provide best mix design, placement and curing techniques to minimize shrinkage cracking.

G. Notify the Design Professional 24 hours in advance of any shotcrete placements and receive permission to proceed before placing any shotcrete.

H. The wall and floor surfaces shall receive a finish as follows:

1. Wood float; steel trowel; then a light broom finish.
2. Interior concrete of the pool shall be finished per drawings.
3. The pool floor shall be wood floated after concrete is placed, shaped and smoothed up before the initial “set” has developed (true for alternate finish also).
4. After curing seven (7) days the entire concrete surface to be acid cleaned to remove any grit, laitance and other concrete components. The acid must be hosed off under pressure.
5. Examine the entire surface for abnormal roughness.

I. Curing and Cold Weather Protection: It is required that surfaces be kept continuously wet for at least seven (7) days. Spray applied membrane curing will not be permitted. The air in contact with shotcrete surfaces shall be maintained at temperatures above freezing for a minimum of seven (7) days. More detailed recommendations on winter protection may be found in ACI 306R.

J. Construction joints shall cross plane changes in the pool structure at no less than a 45 degree angle or run parallel at a minimum distance of 24” to a plane change such as the wall to floor transition, floor slope transitions and wall to wall corners. No joint shall occur within the length of a plane change.

1. Construction joints shall be built using PVC membrane waterstop unless otherwise approved by the Design Professional in advance of any shotcrete placement.
2. Construction cold joints are to be tapered to a thin edge, over a width of about one (1) foot. Square construction joints allowed only where the joint will be subjected to compressive stress. The entire joint shall be thoroughly cleaned and wetted prior to the application of additional shotcrete. No more than two (2) cold joints around perimeter of pool.

a. A slurry of neat cement must be used on all cold joints immediately prior to installation of additional concrete. (submit mix for review - generally portland cement, bonding agent, water)
b. The neat cement application must be preceded by air washing with an air compressor.
c. A cold joint cannot be left longer than 48 hours. If more than 48 hours is used between pours, a construction joint must be used.

K. TESTING - FIELD QUALITY CONTROL

1. The owner will employ, at his own expense, an independent testing agency to conduct quality control testing, unless otherwise specified in Division 1. Concrete not meeting specifications shall be rejected by the Contractor without exception. Contractor will not be compensated for required correction work from concrete not meeting specifications.
2. A slump tests shall be for every 50 cubic yards of shotcrete placed or each day of shotcreting, whichever creates more tests.
3. The Contractor shall cast 1 test panel of shotcrete for each 50 cubic yards of shotcrete placed or each day of shotcreting, whichever creates more test panels. The panel shall be gunned in the same position as the work it represents. The minimum dimensions of the test panel shall be 24" by 24" by 4". The test panel shall be field cured for 48 hours in the same manner as the work it represents. A representative of the Owner or the Design Professional shall transport the test panel to the Testing Agency for required testing.
    a. On each test panel, the Testing Agency shall perform the following tests or tests as directed by the Design Professional:
4. Six, 3" diameter concrete cores shall be obtained in accordance with ASTM C42.
    a. The cores shall be laboratory cured in water for a minimum of 40 hours prior to compressive strength testing (except the 3 day test will be immersed for 24 hours).
    b. The compressive strength of the cores will be documented in sets of two in accordance with ASTM C42 procedures after 3,7 and 28 days of curing.
5. Test reports shall be submitted as soon as practical to the Owner, Design Professional and Contractor.
6. The test results of the compression tests of the quality control samples will be evaluated by the Design Professional based on ACI 301, Chapter 17 criteria. Any tests requested by the Design Professional to verify information as to the concrete strength shall be paid for by the Contractor for any unaccepted concrete. The Owner will pay for the test if the concrete meets specifications.
7. A static test must be performed on the pool shell prior to the application of the pool finish. The test must be completed with considerations taken for evaporation and hydration of the concrete. If the test fails, there shall be no cost to the owner and no extra days added to the contract. All costs for testing is the responsibility of the contractor.

3.06 DIAMOND BRITE POOL FINISH

A. Diamond Brite must be applied to a uniform thickness of 3/8" to ½" over entire pool surface.

B. Before start of work, verify that substrate conditions are acceptable for work to be applied under this section. Inform the Design Professional of any conditions which will preclude satisfactory installation.

C. Supply first class workmanship in all finish work. Use all products in strict accordance with recommendations and directions of manufacturer. Smooth all exposed cut edges. Be sure cut edges are clean before installing finish.

D. Maintain temperatures recommended by manufacturer during application and curing of filler, primer and epoxy.

E. Control joints and joints between each days plastering shall have a ceramic tile joint installed.

F. The installer must be recognized by the manufacturer as a certified installer of Diamond Brite. The name of the installer shall be submitted to the Design Professional prior to any work being done.

3.07 TILE

A. Scope of Work: Includes all labor, material, equipment and incidental services to furnish and install ceramic tile as shown on the drawings. Depth and no diving markers are to be supplied to the deck tiling contractor for installation. Coordinate code required placement and spacing with deck tiling contractor.

B. Submittals: Submit pattern and type of tile intended to be used. Obtain approval of job sample submittals before delivering any products to job site. Submit tile manufacturer's maintenance guides for the Owner's use in maintaining all ceramic tile work herein specified.

C. Product Handling: Deliver all products to job site in manufacturer's unopened containers with grade seals unbroken and labels intact.

D. Environmental Conditions: Maintain temperature at 50 degrees Fahrenheit minimum during tile work and for seven (7) days after completion. Provide adequate lighting for good grouting and clean up.

E. Project Condition: Tile is to be installed on new concrete slabs on grade.

F. Surface acceptance: Before start of work, verify that the substrate conditions are acceptable for work to be applied under this section. Inform the Architect of any conditions which will preclude a satisfactory installation.

G. Mortar Bed at Pool: Mortar Bed acceptable only to eliminate bird baths. Mortar bed for pool bottom shall be one (1) part Portland cement, four (4) parts sand by volume. Scratch coat and mortar bed for walls shall be one (1) part Portland cement, three (3) parts dry sand or four (4) parts wet sand.

H. Installation: All swimming pool tile shall be installed in accordance with ANSI A108.1. Grout for the pool shall be in accordance with ANSI 108.10. On concrete slabs on grade, install in accordance with ANSI A108.3, TCA method F113-89.

I. Layout: Determine locations of all movement joints before starting work. Lay out all tile work so as to minimize cuts less than one-half ( ½) inch in size. Align all joints to give straight uniform grout lines. Make joints between tile sheets same width as joints within sheets, so extent of each sheet is not apparent at finish of work.

J. Location: Depth markers must properly represent the water level where they are located.

K. Workmanship: Supply first class workmanship in all tile work. Use all products in strict accordance with recommendations and directions of manufacturers. Proportional mixes in accordance with latest ANSI Standard Specifications. Smooth all exposed cut edges. Be sure cut edges are clean before installing tiles.

L. Cleaning: Clean tile surfaces as thoroughly as possible on completion of grouting. Remove all grout haze, observing tile manufacturer's recommendations as to use of acid and chemical cleaners. Rinse tile work thoroughly with clean water before and after using chemical cleaners.

M. Protection from Construction Dirt: Cover all tile with heavy duty, nonstaining paper taped securely in place. Prohibit all foot and wheeled traffic for a minimum period of three (3) days. Apply to all clean, completed tile floors a protective coat of neutral cleaner solution, one (1) part cleaner to one (1) part water. Just before final acceptance of tile work, rinse protective coat of neutral cleaner from all tile surfaces.

**END OF SECTION**

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**SECTION 13 11 44**

**POOL CHEMICAL EQUIPMENT**

## PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary conditions, Division 1 and Section 13 11 10, apply to this section.

B. Published specifications, standards, tests, or recommended methods of trade, industry, environmental organizations and applicable code apply to work of this section.

1.02 REFERENCES/REGULATORY REQUIREMENTS

A. Nationally recognized standards, as applicable to all equipment and systems herein shall be adhered to, including, but not limited to NSF International.

B. Chemical Feeder pumps shall be manufactured in accordance to ISO 9001 Certification Standards and shall comply with:

1. UL Listed 7B42.
2. NSF 50 Standard.
3. ETL Equivalent to NSF 50 Standard.
4. CSA Class 9091 01.

C. Controller installed shall meet CE requirements and Data/Voice Modem shall be FCC approved.

D. pH and ORP sensors shall be manufactured in accordance to ISO 9002 Certification Standards and all wetted materials used shall be on FDA white list.

1.03 GENERAL

A. The entire disinfection system and all chemical equipment shall be designed and installed to meet all applicable State and local codes.

1.04 SUMMARY

A. This specification covers the products and installation of equipment utilized in the control of pH adjustments in swimming pool water. The entire system and all related components shall be modular design and shall be supplied as one integrated package from a single source.

B. This specification covers the product and installation of the Controller for pH, ORP & Cl2/Br2/Ozone quantity (ppm) in pool water treatment systems.

C. This specification covers the product and installation of the flowcell, flowswitch and pH & ORP sensors.

D. This specification covers the product and installation of the chlorine system. The chlorination system shall be a sodium hypochlorite system.

E. This specification covers web based software for interactive connection between Controller and PC.

F. This specification shall cover the product and installation of a supplemental ultraviolet disinfection system.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Submit 5 copies of shop drawings/submittals for checking and approval:

1. Chemical controller
2. Chemical feed equipment

3. Other chemical, disinfection, control related equipment

2.02 CHEMICAL CONTROLLER

A. The chemical controller shall be as listed in the equipment list and shall be a complete system including, but not limited to:

1. Controller unit
2. Keypad and digital display
3. Sensors and sensor well
4. Wiring
5. All other accessories required for a fully functioning chemical control system

2.03 PH ADJUSTMENT SYSTEM (ACID)

A. The Owner shall coordinate supply of muriatic acid to the site with storage in the Owner supplied storage tank. The solution shall be injected intermittently or continuously as required for pool and spa applications via a metering pump and chemical controller.

B. The tank shall be sealed with metering pump tubing penetrating the tank lid through holes slightly smaller than the tubing in order to maintain a seal and slightly negative pressure in the tank.

2.04 CHLORINATION SYSTEM (SODIUM HYPOCHLORITE)

A. The Owner shall coordinate supply of sodium hypochlorite to the site with storage in the pool contractor supplied storage tank. The hypochlorite solution shall be injected intermittently or continuously as required for pool and spa applications via a metering pump and chemical controller.

B. The tank shall be sealed with metering pump tubing penetrating the tank lid through holes slightly smaller than the tubing in order to maintain a seal and slightly negative pressure in the tank.

**PART 3 - EXECUTION**

3.01 GENERAL

A. All bypass lines shall be properly supported and run in a neat and workmanlike manner. Bypass and chemical feed lines must be installed in conduit.

B. Installation shall be performed by Owners Representative; on-site start up shall be performed by Manufacturer's Representative.

C. Controller shall be mounted on firm, smooth surface to adequately support weight of the controller and easy access to the Controller shall be allowed.

D. pH and Chlorine/Ozone/Bromine feed injector points are to be installed after heater by-pass and all sample streams.

E. All mountings and anchors shall be non-corrosive material.

**END OF SECTION**

# SECTION 13 11 46

# POOL FEATURES AND EQUIPMENT

## PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary conditions, Division 1 and Section 13 11 10, apply to this section.

B. Published specifications, standards, tests, or recommended methods of trade, industry, environmental organizations and applicable code apply to work of this section.

1.02 GENERAL

A. The Contractor shall furnish and install play features as specified.

B. Shall be furnished by manufacturer providing a guarantee against all failure and defects in workmanship and material for a period of one year from date of acceptance by owner.

1.03 SUMMARY

A. This section of the specifications is intended to describe pool play features and all related appurtenances.

B. This section is intended to describe the supply, handling and installation of shallow water play features.

C. This section is intended to describe the supply, handling and installation of flume water slides.

1.04 QUALITY ASSURANCE

A. Qualifications of Suppliers and Personnel

1. Products are to be installed by the manufacturer or a manufacturer trained contractor.

B. Product quality is of utmost importance.

C. Supplier shall provide insurance certificate illustrating a minimum of $1,000,000 general and product liability per occurrence. In addition to this, the supplier shall send with this bid the proof of excess liability coverage for each occurrence in the amount of $5,000,000. Supplier shall also provide proof of worker's compensation and employer's liability coverage with policy limits of $1,000,000 per line item of coverage and proof of errors and omissions liability coverage in the amount of $1,000,000 each claim.

D. Dimensions and footing layout and design will vary between manufacturers. Those items shown within Drawings and specified are intended to establish minimum standards.

1. For bidding purposes, equipment supplier shall anticipate deviations from items shown on plans and specified herein, and submit his or her bid accordingly.
2. Necessary design deviations shall be the responsibility of the equipment supplier and shall be made to fit manufacturer's specific requirements.

1.05 CODES AND STANDARDS

A. In addition to complying with all applicable codes and regulations, comply with pertinent recommendations contained in:

1. "WWA Considerations for Operation Safety", 1989 and update, as published by the World Waterpark Association.
2. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.
3. "Code for Welding in Building Construction" of the American Welding Society.
4. "Specifications for Architecturally Exposed Structural Steel" of the American Institute of Steel Construction.

5. “Manual of Standard Practice for Detailing Reinforced Concrete Structures”, Publication ACI 315-92 of the American Concrete Institute.
6. “Structural Concrete for Buildings”, Publication ACI 301-96 of the American Concrete Institute.
7. ASTM requirements for all steel components, of the American society of Testing Materials.
8. IBC 2006.
9. ASTM F2376-08

B. Where provisions of pertinent codes and standards conflict with this specification, the more stringent shall govern.

C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

**PART 2 - PRODUCTS**

2.01 GENERAL

A. The feature shall be manufactured from molded fiberglass and other materials inert to pool chemicals. Where metal or steel is supplied as part of the component all such parts shall be manufactured from 304 stainless steel, mild steel components (except valve body) shall not be used regardless of rust preventative coatings.

B. Piping and/or structural tubing shall be six inch rigid corrosion proof, molded reinforced fiberglass material with a smooth high gloss finish.

C. In addition to the standard colors normally offered, the owner has requested the use of custom colors. All bids must include the option for custom colors.

D. The specified in-ground pool spray features (see equipment list) shall be suitable for installation in public swimming facilities as well as splash/wet decks and zero depth entry public swimming pools.

E. All products shall be stainless steel or non-metallic, including heavy duty, high tensile strength PVC or high density molded composites.

F. Gaskets: shall be neoprene closed cell material, ½ inch thick to allow minimal field adjustments for leveling (or similar material).

G. Fasteners: shall be type 304 stainless steel for all anchoring hardware

H. Nozzles: nozzles to be a cast brass.

I. Packaging shall be in a container so as to fully protect that assembly during transport by commercial transit.

2.02 SUBMITTALS

A. Manufacturer for ease of installation shall supply drawings and instructions.

2.03 WARRANTY

A. Shall be furnished by manufacturer providing a guarantee against all failure and defects in workmanship and material for a period of one year from date of acceptance by owner.

2.04 SUBSTITUTIONS

A. Should the bidder wish to substitute products for the product specified, the bidder shall meet the intent of the design selected and associated flow rates. Any deviations from the specified products are at the discretion of the engineer and owner for denial. Pre-approval is required in accordance with specifications.

2.05 DECK EQUIPMENT

A. The rail products and anchors shall be the standard catalogued product of a company regularly engaged in the manufacture of swimming pool deck equipment. Alternate models of grab rails will not be considered unless equal to the specified product in every respect and must be submitted for approval prior to the last addendum issued. Submittal data must include complete documentation

relating to all the specified features and include manufacturer's sales literature, specification sheets, installation/operation/maintenance manuals and engineering drawings.

B. The rail goods shall be fabricated of 1.90-inch O. D. x 0.120-inch wall thickness (minimum), ASTM-A-554 grade 316L stainless steel. The grab rails and their gripping surface shall comply with ADA Accessibility Guidelines for Buildings and Facilities, sections 4.26.2.

C. 6-inch deep escutcheon-less stainless steel compression anchors shall support the rails goods. One anchor spanner wrench shall be supplied.

D. All metallic components shall be passivated, in compliance with ASTM A967-99, incorporating organic acid passivation techniques for maximum corrosion resistance. The finished surface shall be a polished number 6 finish.

E. A two-year warranty shall be provided for all rail goods.

F. Advertising on deck equipment must be limited to ½" lettering in consistent colors with no sales messages or non-approved colors.

**PART 3 - EXECUTION**

3.01 GENERAL

A. The contractor shall install all equipment in accordance with the instructions of the manufacturer or as described on the manufacturer's drawings.

B. All products shall be shipped in a container so as to fully protect that assembly during transport by commercial transit.

C. Manufacturers bidding the project other than the manufacturer listed on the equipment list must verify the flow rates specified meet their requirements. Any required changes from the specified flow rates must be accounted for in the bid.

3.02 INSTALLATION

A. Mounting shall allow the feature to be installed in concrete with stainless steel anchor wedges. An OMNIPOD (or approved equal compatible with approved feature) shall be utilized to allow take down for winterization, swapping of play features, etc.

3.03 DECK EQUIPMENT

A. The Contractor shall install all equipment in accordance with the instructions of the manufacturer or as described on the manufacturer's drawings.

B. All work shall be done in a workmanlike manner with all equipment being installed true and plumb per drawings.

C. Pool contractor shall coordinate all deck equipment and anchor installation with the decking contractor.

D. Supply and install all required thickened slabs or footings unless otherwise stated.

**END OF SECTION**

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**SECTION 13 11 47**

**POOL SIGNAGE**

## PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary conditions, Division 1 and Section 13 11 10, apply to this section.

B. Published specifications, standards, tests, or recommended methods of trade, industry, environmental organizations and applicable code apply to work of this section.

1.02 REFERENCE STANDARDS

A. Any signage offered under these specifications shall comply with local, state and other applicable codes for pool, spa and other related signage. Verify local, state and other requirements before order.

1.03 GENERAL

A. The Contractor shall furnish and install signage as specified.

B. Shall be furnished to provide a guarantee against all failure and defects in workmanship and material for a period of one year from date of acceptance by owner.

C. Signs must be secured to vertical surfaces such that they cannot be tampered with or otherwise destroyed and/or removed by persons, weather and/or other conditions.

1.04 SUMMARY

A. This section of the specifications is intended to describe pool signage.

## PART 2 - PRODUCTS

2.01 GENERAL

A. Signage lettering must be clearly legible in letters no less than ¼" in height.

B. Signage shall be printed on or adhered to 5052-H38 aluminum, .080" thick, complying with ASTM B-209. If signage is adhered to aluminum backing, it shall be constructed of non-corrosive material and adhered using an evenly coated exterior grade adhesive that is applicable for use with the two receiving materials.

2.02 GUARD/SAFETY SIGNAGE

A. Where no lifeguard is on duty; a sign must be placed in plain view within the pool enclosure and must read:

1. In clear legible letters <u>at least four inches high</u>:
   a. "WARNING – NO LIFEGUARD ON DUTY"
2. In clear legible letters <u>at least one inch high</u>:
   a. "CHILDREN MUST NOT USE THE POOL WITHOUT AN ADULT IN ATTENDANCE"

2.03 EMERGENCY TELEPHONE SIGNAGE

A. Where an emergency telephone is located within the pool enclosure; a sign must be placed in plain view within the pool enclosure and must read:

1. In clear legible letters <u>at least one inch high</u>:
   a. "EMERGENCY NUMBER:_____"
2. And must include the appropriate emergency number.

B. Where an emergency telephone is not located within the pool enclosure; a sign must be placed in plain view within the pool enclosure and must read:

1. In clear legible letters at least one inch high:
   a. "TELEPHONE LOCATION:_____"
2. And must include the location of the nearest telephone.

2.04 CAPACITY SIGNAGE

A. The pool capacity must be placed in plain view within the pool enclosure and must read:

1. In clear legible letters at least one inch high:
   a. "POOL CAPACITY: ____ PERSONS"
2. And must include the appropriate pool capacity.

2.05 LIFESAVING EQUIPMENT SIGNAGE

A. All lifesaving equipment must be must be marked in plain view within the pool enclosure and must read:

1. In clear legible letters at least one inch high:
   a. "FOR EMERGENCY USE ONLY"

2.06 POOL RULES

A. A sign must be placed in plain view within the pool enclosure and in the dressing rooms and must read:

1. In clear legible letters at least one inch high:
   a. "People with communicable diseases are not permitted to use the pool"
   b. "People with open sores, blisters, or cuts are not permitted to use the pool"
   c. "Shower before entering pool"
   d. "No spitting, spouting of water or blowing of the nose is permitted in the pool"
   e. "No running or boisterous or rough play"
   f. "No glassware"
   g. "No diving"
   h. "No pets"

**PART 3 - EXECUTION**

3.01 GENERAL

A. Signage must be supplied, posted and plainly visible.

B. Signage must be located at the pool and all locker rooms.

**END OF SECTION**

# SECTION 142400 - HYDRAULIC ELEVATORS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. This Section includes hydraulic passenger elevators.

B. See Division 09 Sections for finish flooring in elevator cars. Finishes selected as indicated on the drawings and finish schedule.

### 1.2 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For exposed finishes.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Operation and maintenance data.

F. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

### 1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with ASME A17.1.

B. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and MN Chapter 1341.

### 1.4 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

## 1.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide one year's full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Otis Elevator Co.
2. Schindler Elevator Corp.
3. ThyssenKrupp Elevator.

## 2.2 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard elevator systems, including standard components published by manufacturer as included in standard preengineered elevator systems and as required for complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.

1. Pump mounted on oil tank with vibration isolation mounts. Enclose pump in prime-painted steel enclosure lined with 1-inch- (25-mm-) thick, glass-fiber insulation board.
2. Provide motor with solid-state starting.

C. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.

D. Hydraulic Fluid: Nontoxic, readily biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.

E. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides. Provide guide rails capable of spanning the floor to floor heights.

## 2.3 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation system indicated.

B. Single-Car Auxiliary Operations:

1. Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

C. Security Feature: Security feature shall not affect emergency firefighters' service.

1. Card-Reader Operation: System uses card readers at car control stations to authorize calls. Security system determines which landings and at what times calls require authorization by card reader.

## 2.4 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

## 2.5 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

D. Stainless-Steel Bars: ASTM A 276, Type 304.

E. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

F. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063.

G. Plastic Laminate: High-pressure type complying with NEMA LD 3, Type HGS or HGL.

## 2.6 CAR ENCLOSURES

A. General: Provide enameled-steel car enclosures to receive removable wall panels, with car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.

2. Wall Panels: Selected by owner’s interior designer.
3. Stainless-Steel Doors: Flush, hollow-metal construction.
4. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
5. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.

## 2.7 HOISTWAY ENTRANCES

A. General: Provide manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Stainless-Steel Frames: Formed from stainless-steel sheet.
2. Stainless-Steel Doors and Transoms: Flush, hollow-metal construction.
3. Sills: Extruded aluminum, with grooved surface, 1/4 inch (6.4 mm) thick.
4. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.

## 2.8 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements with LEDs.

B. Car Control Stations: Provide manufacturer's standard car control stations. Mount in return panel adjacent to car door, unless otherwise indicated.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.

E. Hall Lanterns: Units with illuminated arrows.

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.

## 2.9 ELEVATORS

A. Elevator Description:

1. Type: Holeless, beside-the-car, single-acting, single or dual cylinder.
2. Rated Load: 3500 lb (1135 kg).
3. Rated Speed: 100 fpm (0.51 m/s).

4. Operation System: Single automatic operation.
5. Auxiliary Operations:

    a. Battery-powered lowering.

6. Car Enclosures:

    a. Inside Width: 6’-8” from side wall to side wall.
    b. Inside Depth: 5’-5” from back wall to front wall (return panels).
    c. Inside Height: 7’-10” to underside of ceiling.
    d. Front Walls (Return Panels): Satin stainless steel, No. 4 finish with integral car door frames.
    e. Car Fixtures: Satin stainless steel, No. 4 finish.
    f. Side and Rear Wall Panels: as indicated on the drawings and finish schedule.
    g. Door Faces (Interior): Satin stainless steel, No. 4 finish.
    h. Handrails: 1/2 by 2 inches (13 by 50 mm) rectangular satin stainless steel, No. 4 finish, at sides and rear of car.
    i. Floor prepared to receive carpet as indicated on the drawings and finish schedule.

7. Hoistway Entrances:

    a. Width: 3’-6”.
    b. Height: 7’-0”.
    c. Type: Single-speed side sliding.
    d. Fire-Protection Rating: 2 hour.
    e. Frames: Satin stainless steel, No. 4 finish.
    f. Doors and Transoms: Satin stainless steel, No. 4 finish.

8. Hall Fixtures at First Floor, Basement Floors, Other Floors: Satin stainless steel, No. 4 finish.
9. Additional Requirements:
    a. Provide blanket hooks and one complete set of full-height protective blankets.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

B. Leveling Tolerance: 1/4 inch (6 mm), up or down, regardless of load and direction of travel.

C. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

## 3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

## 3.3 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Engage elevator Installer to provide full maintenance service.
3. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

## 3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 142400

**SECTION 220513**

**ELECTRIC MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Single phase and three phase electric motors.

### 1.02 RELATED DOCUMENTS

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

B. Section 223000 – Plumbing Equipment.

C. Section 262726 – Wiring Devices.

### 1.03 REFERENCES

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2006.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

### 1.05 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for the purpose specified and indicated.

### 1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

**1.07 WARRANTY**

A. Comply with requirements of Division 1.

**PART 2 PRODUCTS**

**2.01 ELECTRIC MOTOR GENERAL CONSTRUCTION AND REQUIREMENTS**

A. Furnish electric motors as required for each motor driven unit. All motors must conform in every respect to the standard specifications of NEMA and bear nameplate of manufacturer, with current operating characteristics noted thereon. Motors shall be U.L. approved.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. All electric motors shall be sized to meet the horsepower requirements of the driven unit at design characteristics including all V-belt and/or drive and coupling losses which are incurred without loading the motor beyond its nameplate horsepower rating. Where V-belt drives are employed, the motor horsepower nameplate ratings shall not be less than 115% of the driven unit brake horsepower requirements.

D. All motors shall be provided with ball roller bearings, and shall have provisions for lubrication unless specified otherwise. Motors shall be quiet when operating under full load operations. See schedules on the Mechanical/Electrical (ME) drawings for capacities.

E. Single phase motors shall be capacitor start, drip-proof. Three phase motors general purpose, squirrel cage induction type unless specified otherwise. Minimum service factors shall be 1.15. All motors single speed, 1750 rpm, unless specified otherwise for specific equipment.

F. Electric motor characteristics shall be as indicated on the drawings.

G. All three phase motors for mechanical equipment rated 1 horsepower and larger shall meet NEMA Premium Efficiency standards as shown on the following table. Motors shall be labeled to comply with NEMA Standard MG1-12.53 with the nominal efficiency printed on the nameplate. Efficiency to be based on a dynamometer test per IEEE, Standard 112, Method B.
   1. Minimum efficiency shall be provided per schedule.

**MOTOR SCHEDULE**

| | Open Drip-Proof (ODP) | | | Totally Enclosed Fan-Cooled (TEFC) | | |
|---|---|---|---|---|---|---|
| | 1200 RPM | 1800 RPM | 3600 RPM | 1200 RPM | 1800 RPM | 3600 RPM |
| HP | | | | | | |
| 1 | 82.5 | 85.5 | 77 | 82.5 | 85.5 | 77 |
| 1.5 | 86.5 | 86.5 | 84 | 87.5 | 86.5 | 84 |
| 2 | 87.5 | 86.5 | 85.5 | 88.5 | 86.5 | 85.5 |
| 3 | 88.5 | 89.5 | 85.5 | 89.5 | 89.5 | 86.5 |

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Check line voltage and phase and ensure agreement with nameplate.

**3.02 WIRING**

A. All 120V and low voltage control wiring for equipment provided by this Contractor shall be responsibility of this Contractor unless specified otherwise and clearly stated.

B. Electrical work shall comply with the requirements of the current applicable National Electrical Code and Division 26. Where this specification or the plans indicate requirements in excess of those of NEC, the compliance with NEC will not relieve the Contractor from furnishing and installing work as shown or specified.

C. All switching, protective devices and controls for equipment furnished under these Specifications shall be identified with black-white-black laminated 1/8" plastic plates. Plates shall be attached with self-tapping screws.

**END OF SECTION**

**SECTION 220519**

**METERS AND GAUGES FOR PLUMBING PIPING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Pressure and temperature test stations.

D. Domestic water meter.

### 1.02 RELATED DOCUMENTS

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

B. Section 221005 - Plumbing Piping.

### 1.03 REFERENCES

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 2005.

B. ASTM E 1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2003a.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 2005 (Reapproved 2003).

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

### 1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

## PART 2 PRODUCTS

### 2.01 PRESSURE GAUGES

A. Gauge: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass wells, with front recalibration adjustment, black scale on white background.

1. Dial: 4-1/2" (6" if installed 15' above floor) black on white, red tip pointer.
2. Case: Aluminum, clear glass window.
3. Bourdon Tube: Bronze, silver brazed.
4. Movement: Brass-bronze brushed-rotary type.
5. Scale: PSI

B. Range
   1. One and one half (1-1/2) times the maximum system pressure.

C. Acceptable Manufacturers:
   1. Weiss
   2. March
   3. Trerice
   4. U S Gauge
   5. Weksler

**2.02 PRESSURE GAUGE TAPPINGS**

A. Gauge Cock: Brass tee handle, 1/4 inch connections, rated for maximum pressure of 200 psig and maximum temperature of 500 degrees F.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.

**2.03 THERMOMETERS**

A. Thermometer:
   1. Case: Aluminum, 9", clear plastic or glass window.
   2. Scale and Tube: Black on white, red reading.
   3. Stem and Well: Angle adjustable stem, separable well, with extended neck where required for insulated piping.

B. Range
   1. Plumbing 30 degrees F to 240 degrees F

C. Acceptable Manufacturers:
   1. Weiss
   2. March
   3. Trerice
   4. U S Gauge
   5. Weksler

**2.04 THERMOMETER WELLS**

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Well: Separable well, with extended neck where required for insulated piping.

**2.05 PRESSURE AND TEMPERATURE TEST STATIONS**

A. “Pete’s Plug”, a 1/4 inch MPT fitting, to receive either a temperature or pressure probe, 1/8 inch O.D. Fitting shall be solid brass with valve core of Nordal (maximum 275 degree F.) fitted with a gasketed cap and rated at 1000 psig.

B. Supply Owner with pressure gauge adapters with 1/8 inch O.D. probe, two (2) pressure gauges for each range required, four (4) 5 inch stem pocket testing thermometers; two (2) 25 – 125 degree F. for chilled water and two (2) 50 – 500 degree F. for hot water. Provide carrying case for gauges and thermometers.

**2.06 WATER METER**

A. Provide a water meter obtained from and/or approved by the City or local municipality, of a type and size as required for the GPM maximum flow, at a maximum pressure loss of in PSI. The contractor shall be responsible for the GPM and PSI requirements.

**2.07 IRRIGATION METER**

A. Provide a water meter obtained from and/or approved by the City or local municipality, of a type and size as required for the GPM maximum flow, at a maximum pressure loss of in PSI. The contractor shall be responsible for the GPM and PSI requirements.

**PART 3 EXECUTION**

**3.01 PRESSURE GAUGES**

A. Install pressure gauges in accordance with manufacturer's instructions.

B. Pressure gauges shall read one and one-half (1-1/2) times system pressure.

C. Install pressure gauges with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.

D. Install pressure gauges and in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Adjust pressure gauges to final angle, clean windows and lenses, and calibrate to zero.

F. Provide pressure gauges where indicated on drawings and at the following locations:
1. Water main service entrance after the meter or building backflow preventer
2. Pumps - suction and discharge.
3. Pressure reducing valves (upstream and downstream).
4. Domestic water booster system suction and discharge.
5. Water softener system outlet.
6. Additional locations as shown on the drawings and/or details.

**3.02 THERMOMETERS**

A. Install thermometers in accordance with manufacturer's instructions.

B. Install thermometers in piping systems in wells.

C. Install thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust thermometers to final angle, clean windows and lenses, and calibrate to zero.

E. Provide thermometers where indicated on drawings and at the following locations:
1. Water heater, hot water outlet.

2. Mixing valve, cold water inlet, hot water inlet and mixed water outlet.
3. Heat exchanger cold water inlet, hot water outlet.
4. Additional locations as shown on the drawings and/or details.

### 3.03 WATER METERS AND IRRIGATION METERS

A. Verify installation requirements with municipality.

B. Provide support brackets as needed and shut off valves on each side of meter.

C. Insulate meter body and provide access to totalizer cover.

D. Perform flow test to verify meter is operational.

E. Water meters located within 5 feet of a plumbing fixture, within the same room, shall be shielded from contamination.

**END OF SECTION**

**SECTION 220523**

**GENERAL DUTY VALVES FOR PLUMBING PIPING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Valve accessories:
   1. Ball valves.
   2. Gate valves.
   3. Butterfly valves.
   4 Balance valves.
   5. Check valves.

### 1.02 RELATED DOCUMENTS

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

B. Section 220519 – Meters and Gauges for Plumbing Piping.

C. Section 220529 – Hangers and Supports for Plumbing Piping and Equipment.

D. Section 220553 – Identification for Plumbing Piping and Equipment.

E. Section 220719 – Plumbing Piping Insulation.

F. Section 221005 – Plumbing Piping.

G. Section 221006 – Plumbing Piping Specialties.

H. Section 223000 – Plumbing Equipment.

I. Section 224000 – Plumbing Fixtures.

### 1.03 REFERENCES

A. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide data on valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of all valves and note on drawings any deviations from the contract documents.

**1.05 QUALITY ASSURANCE**

A. Valves: Manufacturer's name and pressure rating marked on valve body.

**PART 2 PRODUCTS**

**2.01 BALL VALVES**

A. Pipe sizes 4 Inches and smaller: Bronze body 400 psi WOG full port ball valve, lever handle, chrome plated bronze or stainless steel ball, Virgin TFE seat, Virgin TFE stuffing box seal, soldered ends.

B. Acceptable Manufacturers:
   1. Apollo 77-200 Series
   2. Nibco, Inc. T-585-70-66
   3. Milwaukee BA-450.
   4. Watts B6081

**2.02 GATE VALVES**

A. Pipe size to 3".
   1. 125# gate with bronze body, rising stem, solid disc, threaded ends.
   2. Acceptable Manufacturers:
      a. Stockham B-105
      b. Millwaukee 1152
      c. Nibco T-111.
      d. Jomar T301.

B. Pipe size to 3".
   1. 125# gate with bronze body, rising stem, solid disc, soldered ends.
   2. Acceptable Manufacturers:
      a. Stockham B-120
      b. Milwaukee 149
      c. Nibco S-111

C. Pipe Sizes 3” and Larger:
   1. 150#, ductile gate, with O.S. & Y, solid wedge disc, bolted bonnet, flanged.
   2. Acceptable Manufacturers:
      a. Stockham Fig. D-623
      b. Milwaukee F-2885
      c. Wilkins Series 48

**2.03 BUTTERFLY VALVE**

A. Pipe sizes 2-1/2” and larger. Cast iron butterfly valve with extended neck for insulation, 316 stainless steel shaft and disc, EPDM seat and shaft seals capable of bubble tight shutoff at 150 psi differential. Lever operators shall be used on valves less than 6”, gear operated on valves 6” and larger. Tapped lug body shall be used.

B. Acceptable Manufacturers:
   1. Mueller

**2.04 STOP AND WASTE VALVES**

A. Construction, 400 psi CWP, brass, two piece body, chrome plated brass ball, full port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends with drain outlet on non-pressure side.

B. Acceptable Manufacturers:
   1. Apollo Series 95-100
   2. Watts B6301
   3. Jomar (S or T) 100 STN

**2.05 DRAIN VALVES**

A. Construction, 200 psi, bronze ball valve 1/2 or 3/4 inch threaded inlet, 3/4 inch hose threaded outlet.

B. Acceptable Manufacturer:
   1. Apollo Series 78-100.
   2. Watts B-600-CC.
   3. Nibco T-585-70-66-HC
   4. Jomar (T or S) 100 H

**2.06 BALANCE VALVES**

A. 125 lb. and less
   1. Globe valve for balancing and positive shut off, nonferrous metal capable of positive shutoff, with multi-turn adjustment for maximum balance and tamperproof memory stop. Position display window on handwheel.
   2. Pressure/temperature readout ports for measurement through a portable meter.
   3. Meter - Compatible with balance valve. Portable computerized with quick connections capable of reading flow measurements in gpm.

B. Acceptable Manufacturers:
   1. Tour Andersson - STAS
   2. Nibco 1710 Series thru 2”
   3. Mepco MPV Series

**2.07 CHECK VALVES**

A. Pipe sizes 3 inch and smaller Class 125, bronze body, bronze disc, renewable seat.

B. Acceptable Manufacturers:
   1. Stockham B-309Y or B-319Y.
   2. Nibco T-413B or S-413B.
   3. Milwaukee Model 508.

**PART 3 EXECUTION**

**3.01 INSTALLATION - GENERAL REQUIREMENTS**

A. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220719.

B. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 1.

**END OF SECTION**

**SECTION 220529**

**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Hangers and Supports.

### 1.02 RELATED DOCUMENTS

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

B. Section 220523 – General Duty Valves for Plumbing Piping.

C. Section 220719 – Plumbing Piping Insulation.

D. Section 221005 – Plumbing Piping.

E. Section 221006 – Plumbing Piping Specialties.

F. Section 223000 – Plumbing Equipment.

G. Section 224000 – Plumbing Fixtures.

### 1.03 REFERENCES

A. ASME B31.9 – Building Services Piping; The American Society of Mechanical Engineers; 2008.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide data on hangers and supports. Provide manufacturers catalog information.

## PART 2 PRODUCTS

### 2.01 PIPE HANGERS AND SUPPORTS

A. Conform to ASME B31.9.

B. All individual pipes shall be supported with adjustable clevis hangers, where required size to encompass insulated pipe.
   1. Anvil Fig. 260, or approved equal.
   2. Anvil Fig. CT-65, or approved equal (uninsulated copper pipe).

C. "Trapeze" hangers shall be Unistrut or B-Line channels, for piping 3" and smaller. For piping 4" to 6" use 2" x 2" x 1/4" angle iron, for piping 8" to 12" use 3" x 3" x 3/8" angle iron using the appropriate diameter rod that will sufficiently support the weight of all of the pipe and their contents being supported and nutted on both sides of the iron.

D. Hanger Rods, etc.: Mild steel continuous threaded rod, heavy washers and heavy hex nuts.

**2.02 ATTACHMENTS TO STRUCTURE**

A. Concrete
   1. Poured - for loads between 400 lbs. and 1140 lbs.
      a. Anvil Fig. 282.
   2. Poured - For loads up to 400 lbs.
      a. Anvil Fig. 285 or U channel type; B - Line B221 or Unistrut.
   3. Precast - Tapered wedge with locking sleeve: Quick Bolt.

B. Steel Beam Structure
   1. Beam Clamp
      a. For loads up to 1070 lbs. - Anvil Fig. 94, or approved equal.
      b. For loads up to 470 lbs. - Anvil Fig. 93, or approved equal.
   2. Welded beam attachment - Anvil Fig. 66.
   3. Steel washer and heavy nut for split joists.
   4. Angle or channel iron support spanning between beams and joists.

C. Wood
   1. Drill and use through bolts nutted on both sides of joist and malleable iron eye sockets.

**2.03 HANGER INSERTS**

A. Concrete inserts for loads between 400 and 1140 lbs.
   1. Anvil Fig. 282, or approved equal.

B. Concrete inserts for loads up to 400 lbs.
   1. Anvil Fig. 285, or approved equal.

**2.04 VERTICAL PIPE SUPPORTS**

A. All vertical piping shall be supported at each floor using riser clamps.
   1. Anvil Fig. 261 (cast iron, steel, and insulated copper pipe).
   2. Anvil Fig. CT 121 (uninsulated copper pipe).

**2.05 SHEET METAL SHIELDS**

A. Sheet metal shields shall be Anvil Fig. 167 or galvanized sheet metal of equal gauge thickness.

**2.06 ACCEPTABLE MANUFACTURER:**

A. Anvil

B. Felker

C. Hycon

D. Piping Tech.

E. Unistrut

F. B-Line

G. Superstrut

H. Michigan\Erico

I. Holdrite

**PART 3 EXECUTION**

**3.01 INSTALLATION - GENERAL REQUIREMENTS**

A. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220719.

B. Provide all hangers and supports as required.

**3.02 PIPE HANGERS AND SUPPORTS**

A. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Whenever copper piping comes directly in contact with steel support system, it shall be this Contractor's responsibility to wrap the pipe with two layers of 3M's #33 electrolytic tape. The length of tape shall be such to provide 2" overlap on each side of support
9. Support cast iron drainage piping at every joint.
10. Insulated pipe support shall be supported with polysiocyanurate pipe insulation the same thickness as insulated pipe. Install between pipe and vapor barrier.
11. Supports shall be sized for weights and pipe sizes encountered.
12. Supports shall properly compensate for all thermal expansion and contraction.

B. Horizontal Hanger Spacing Schedule

1. Steel Pipe

| Pipe or Tube Size | Hanger Spacing | Minimum Rod Diameter |
|---|---|---|
| 1/2" tube only | 5' | 1/4" |
| 1/2" - 1" | 7' | 3/8" |
| 1-1/4" - 1-1/2" | 9' | 3/8" |
| 2" | 10' | 1/2" |
| 2-1/2" | 11' | 1/2" |
| 3" | 12' | 1/2" |
| 4" | 14' | 5/8" |

| | | |
|---|---|---|
| 5" | 16' | 5/8" |
| 6" and larger | 17' | 3/4" |

2. Copper Pipe

| Pipe or Tube Size | Hanger Spacing | Minimum Rod Diameter |
|---|---|---|
| 1/2" | 6' | 3/8" |
| 3/4" | 6' | 3/8" |
| 1" | 6' | 3/8" |
| 1-1/4" | 6' | 3/8" |
| 1-1/2" | 9' | 3/8" |
| 2" | 9' | 3/8" |
| 2-1/2" | 10' | 1/2" |
| 3" | 10' | 1/2" |
| 3-1/2" | 10' | 1/2" |
| 4" | 10' | 1/2" |

3. Cast Iron Storm, Waste and Vent Pipe

| Pipe or Tube Size | Hanger Spacing | Minimum Rod Diameter |
|---|---|---|
| 1/4" to 1-1/2" | 5' | 3/8" |
| 2" | 5' | 3/8" |
| 2-1/2" | 5' | 3/8" |
| 3" | 5' | 3/8" |
| 4" | 5' | 3/8" |
| 5" | 5' | 5/8" |
| 6" to 12" | 5' | 5/8" |

Note: 10' hanger spacing may be used for piping in 10 foot lengths.

**3.03 VERTICAL PIPE SUPPORTS**

A. Cast-iron soil pipe, at base and at each story height. Neoprene jointed pipe at five foot intervals, except where ten foot lengths are used.

B. Threaded pipe, every other story height.

C. Copper tubing, at each story.

D. Exposed plastic pipe, 1-1/4 inch and 1-1/2 inch sizes, at four foot intervals.

E. Concealed plastic pipe and exposed plastic pipe two inch and over, at each story.

**3.04 BRACKETS, BRACES AND SUPPORTS**

A. Provide brackets, braces or reinforcing angles as may be required in all partitions, not sufficient in themselves to support fixtures or other wall mounted equipment included in this specification.

B. Pipe shall be supported from the building structure independently or from a separate support, no pipe line shall be supported from another pipe line or piece of equipment.

C. No equipment shall be supported by the piping system itself. All units shall be supported in a manner to allow service without removing large piping segments or valves. Provide structural members as required.

D. On thin masonry or hollow tile walls that are to be finished on opposite side of wall, use 3/8" brass through bolts extended entirely through wall with 3" cut washer on opposite side of wall. Bolt heads and washers shall be concealed under wall finish on opposite side of wall. On walls of accessible pipe spaces, use 3/8" brass through bolts and 3" cut washers exposed in pipe spaces.

E. On brick, masonry block, hollow tile or concrete walls not finished on opposite side of wall, use brass toggle bolts or 3/8" brass bolts extending at least 3" into wall secured in place lead inserts and caulked with silicone type caulk.

**END OF SECTION**

**SECTION 220553**

**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Labels.

### 1.02 RELATED DOCUMENTS

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

B. Section 220519 – Meters and Gauges for Plumbing Piping.

C. Section 220523 – General Duty Valves for Plumbing Piping.

D. Section 221005 – Plumbing Piping.

E. Section 221006 – Plumbing Piping Specialties.

F. Section 223000 – Plumbing Equipment.

G. Section 224000 – Plumbing Fixtures.

### 1.03 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturer’s catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Brady Corporation.

B. Champion America, Inc.

C. Seton Identification Products.

### 2.02 IDENTIFICATION – EQUIPMENT NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2 inch.
   3. Background Color: Black.

### 2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

### 2.04 IDENTIFICATION - PIPE

A. Color: Conform to ASME A13.1.

B. Plastic Tape Pipe Labels: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Pipe: Labels shall describe the contents and direction of flow. Labels shall be secured to pipe with full self-adhesive banding around pipe at each end of label. Labels shall be per the schedule in Part 3.

### 2.05 IDENTIFICATION – VALVES

A. Colored plastic with 1/2" white letters such as Bakelite attached with a brass chain.

B. Control valves shall be tagged as to service and normal position.

C. Other valves tagged as to service and function.

D. Control valve tags shall have black background, other valves tags shall have colors corresponding to service described above.

### 2.06 IDENTIFICATION - EQUIPMENT

A. Black plastic with 1" white letters such as Bakelite attached with screws to equipment for its labeling.

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

**3.02 INSTALLATION**

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion-resistant chain.

C. Install pipe labels in accordance with manufacturer's instructions.

D. Install pipe labels complete around pipe in accordance with manufacturer's instructions.

E. Identify pumps, and tanks with nameplates. Small devices, such as in-line pumps, may be identified with tags.

F. Identify valves in main and branch piping with tags. Valve list shall be included in Operation and Maintenance Manual.

G. Identify piping, concealed or exposed, with pipe labels. Use tags on piping 3/4 inch diameter and smaller. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 50 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

**3.03 PIPE IDENTIFICATION SCHEDULE**

| | |
|---|---|
| DOMESTIC COLD WATER | G/W |
| DOMESTIC HOT WATER | Y/B |
| RECIRCULATING HOT WATER | Y/B |
| NON - POTABLE WATER | Y/B |
| RAIN WATER | G/W |
| SANITARY DRAIN | G/W |
| SANITARY SEWER | G/W |
| SANITARY VENT | G/W |
| NATURAL GAS | Y/B |
| | |
| Y/B =YELLOW BACKGROUND/ BLACK LETTERS | |
| G/W = GREEN BACKGROUND/ WHITE LETTERS | |
| R/W = RED BACKGROUND/ WHITE LETTERS | |
| B/W = BLUE BACKGROUND/ WHITE LETTERS | |
| | |

| Pipe Size | Band Width | Letter Height |
|---|---|---|
| 1/2" - 1-1/4" | 8" | 1/2" |
| 1-1/2" - 2" | 8" | 3/4" |
| 2-1/2" - 6" | 12" | 1-1/4" |
| 8" - 10" | 24" | 2-1/2" |
| 10" & UP | 32" | 3-1/2" |

**END OF SECTION**

**SECTION 220716**

**PLUMBING EQUIPMENT INSULATION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Equipment insulation.

B. Covering.

### 1.02 RELATED DOCUMENTS

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

B. Section 220553 - Identification for Plumbing Piping and Equipment.

C. Section 221005 - Plumbing Piping.

D. Section 223000 – Plumbing Equipment

### 1.03 REFERENCES

A. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2005.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.

C. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

D. NFPA 225 Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

E. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc; 2003

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

### 1.05 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

**PART 2 PRODUCTS**

**2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION**

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. Acceptable Manufacturers:
1. Knauf Insulation.
2. Johns Manville Corporation.
3. Owens Corning Corp.
4. CertainTeed Corporation.
5. Armaflex

**2.01 TYPE 1 - FOAM PLASTIC TUBULAR AND SHEET INSULATION**

A. Flexible elastomeric material with 3/4" thickness designed for varied services at temperatures between -40 degrees F and 220 degrees F.

B. Fittings for piping shall be insulated with mitered segments which match the material used. All butt joints shall be joined by sealing with a waterproof vapor barrier adhesive as recommended by the insulation manufacturer.

C. When applying sheet insulation to metal surfaces, brush on a coat of adhesive to the clean, dry metal, covering an area to the size of one sheet. Apply a brushcoat of adhesive to the back of the sheet, except for 1/2" wide border around the edges. After adhesive is on the metal surface and the sheet has dried to a non-sticky state, position sheet so that the edges overlap the previously installed sheets by 1/8". Apply light pressure to adhere a spot in the center of the sheet only and compress butt edges into place. Bond sheet by pressing firmly into place. Spread joints and coat with adhesive. DO NOT FILL JOINT WITH ADHESIVE.

D. For outdoor application, apply two coats of finish as recommended by the insulation manufacturer.

E. Acceptable manufacturers:
1. AP / Aramaflex 25/50 – Armacell International

**2.02 TYPE 2 - EXTERNAL SEMI RIGID FIBERGLASS INSULATION (EQUIPMENT)**

A. Equipment as indicated herein shall be covered with a semi-rigid fiber board material. Insulation shall have an average thermal conductivity not to exceed K = 0.32 Btu in/hr. sq. ft. degrees F at a mean temperature of 200 degrees F, 2-1/2 lb. density, maximum temperature usage 850 degrees with aluminum foil facing.

B. Application
1. Insulation shall be applied over pins welded to the duct, breeching or vessel. All joints shall be staggered and tightly butted.

2. Over the insulation and finishing cement, Glass Cloth shall be smoothly adhered with Childers CP-52, Insul-Coustic IC 102 or equal.

C. Acceptable Manufacturer:
   1. Fiberglass 700 – Owens Corning
   2. Fabrication Board – Johns Manville

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Install insulation materials with smooth and even surfaces and on clean, dry surfaces. Redo poorly fitted joints. Do not use mastic or joint as filler for gapping joints and voids resulting from poor workmanship. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

D. Do not apply insulation to equipment while hot.

E. Cover insulated surfaces with glass cloth jacketing neatly fitted and firmly secured. Lap seams at least two inches.

F. Do not insulate handholes, cleanouts, ASME stamp and manufacturer’s nameplate. Provide neatly leveled edge at interruptions of insulation.

G. 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.

### 3.03 SCHEDULES

A. Plumbing Systems:
   1. Roof Drain Bodies and Water Meters - All surfaces of the roof drain body and water meters shall be insulated with 3/4" thick insulation as described by Type 1, Part 2 - Products.

B. Water Heaters
   1. All surfaces shall be insulated with 2” thick insulation as described by Type 2, Part 2 - Products. Exception – Refer to 220716-3.02-B.

**END OF SECTION**

**SECTION 220719**

**PLUMBING PIPING INSULATION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

### 1.02 RELATED DOCUMENTS

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

B. Section 220529 – Hangers and Supports for Plumbing Piping and Equipment.

C. Section 221005 - Plumbing Piping.

D. Section 224000 - Plumbing Fixtures.

### 1.03 REFERENCES

A. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2005.

B. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2006.

C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.

D. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

G. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

## 1.05 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

## PART 2 PRODUCTS

## 2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. Acceptable Manufacturers:
   1. Knauf Fiber Glass.
   2. Johns Manville Corporation.
   3. Owens Corning Corporation.
   4. CertainTeed Corporation
   5. Armaflex

## 2.02 TYPE 1 - FIBERGLASS PIPE & FITTING INSULATION

A. Pipe
   1. Preformed fiberglass with Kraft reinforced foil vapor barrier jacket suitable for painting, with a maximum thermal conductivity of K = .25 Btu in./hr. sq. ft. at 75 degrees F and rated for 0 degrees F to +850 degrees F service.

B. Fittings
   1. Pre-molded one-piece PVC insulated fitting covers with fiber glass insulation inserts shall be provided on all valves, strainers, elbows, tees, and fittings, etc. Insert shall have a maximum thermal conductivity of K = .28 Btu in./hr. sq. ft. and rated for 0 deg. to 450 degrees.

C. Application
   1. Insulate all piping in a neat, workmanlike fashion in accordance with thickness listed. Longitudinal laps of jackets shall be sealed and butt joints shall be wrapped with a 3" minimum wide strip of the jacketing material securely sealed in place.
   2. In lieu of the above method of application for AP jackets, contractor may elect to use factory-applied pressure sensitive laps and butt strips.
   3. Domestic cold water, domestic hot water, domestic recirculated hot water, tempered water, and rain water conductors shall be insulated as above and have all seam edges of the cover sealed with vapor-barrier adhesive mastic. The circumferential edges of the cover shall be wrapped with vapor-barrier pressure-sensitive color-matching tape. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least two inches on the downward side.
   4. Pre-molded insulated fitting covers shall be factory precut and insulation shall be applied to the fitting. The ends of the insulation shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe covering tufted and tucked in fully insulating the pipe fitting. The one-piece PVC fitting cover will be secured by banding or taping the ends to the adjacent pipe covering. On fittings where the operating temperature exceeds 250 degrees F or where the pipe insulation thickness is greater than 1-1/2", two or more layers of the insulation inserts shall be applied prior to the installation of the PVC fitting cover.

5. Fittings on small pipes 1-1/2" and smaller may be insulated using mitered insulation at the fittings joined with foil faced pressure sensitive tape and 4 oz. canvas jacket.

### 2.03 TYPE 3 - PIPING JACKETS

A. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   1. Minimum Service Temperature: 0 degrees F.
   2. Maximum Service Temperature: 150 degrees F.
   3. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E 96.
   4. Thickness: 10 mil.
   5. Connections: Brush on welding adhesive.

B. Covering Adhesive Mastic:
   1. Compatible with insulation.

### 2.04 TYPE 4 - PIPING SAFETY JACKETS

A. Provide products that comply with the following:
   1. Americans with Disabilities Act (ADA), Article 4.19.4.
   2. ANSI/ICC A117.1, American National Standard for Accessible Buildings and Facilities.
   3. Requirements of applicable building code.

B. Piping Safety Covers:
   1. Characteristics: Three-piece molded assembly, minimum 1/8 inch wall thickness, with internal ribs to provide air space between piping and piping insulation jacket, molded to receive manufacturer's snap-clip fasteners.
   2. Vinyl Material: Impact-resistant and stain-resistant molded closed-cell anti-microbial vinyl compound, UV-stable, non-fading, non-yellowing; having the following performance characteristics:
      a. Burning Characteristics: 0 seconds Average Time of Burning (ATB), 0 mm Area of Burning (AEB), when tested in accordance with ASTM D 635.
      b. Thermal Conductivity: K-value 1.17, when tested in accordance with ASTM C 177.
      c. Indentation Hardness: 60, minimum, when tested in accordance with ASTM D 2240, using Type A durometer.
   3. Trap Assembly Cover: Three-piece assembly, with removable clean-out nut enclosure.
   4. Angle Stop Covers: Formed with hinged cap for access to valve without requiring cover removal.
   5. Configurations: In accordance with manufacturer's product data for project piping configurations indicated on drawings.
   6. Color: China White, gloss finish; paintable.
   7. Fasteners: Manufacturer's standard re-usable snap-clip fasteners; wire-tie fasteners not permitted.
   8. Acceptable Manufacturers:
      a. Truebro Lav-Guard 2

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

**3.02 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert material: Hydrous calcium silicate insulation as described by Type 2 in Part 2 – Products, suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, comply with Division 7 firestopping.

**3.03 SCHEDULES**

A. Domestic Hot and Cold Water, Recirculating Hot Water, Tempered Water
   1. All piping & fittings shall be insulated with 1" thick fiberglass as described by Type 1 in Part 2 - Products.

B. Rainwater
   1. All piping shall be insulated with 1" thick fiberglass as described by Type 1 in Part 2 - Products.

C. Piping Jacket
   1. All exposed piping including tunnels, except in mechanical rooms, shall be covered with piping jacket as described by Type 3 in Part 2 - Products.

D. Pipe Safety Covers
   1. For all lavatory and kitchen hand wash sinks the exposed cold and hot water supply and waste pipes shall be insulated with pipe safety covers as described by Type 4 in Part 2 – Products.

**END OF SECTION**

**SECTION 220993**

**SEQUENCE OF OPERATIONS FOR HVAC CONTROLS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Sequence of operation for:
   1. Domestic Water Recirculating Pump.
   2. Domestic Water Booster Pump.

### 1.02 RELATED DOCUMENTS

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

### 1.03 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire system and each piece of equipment.
   1. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures.
   2. Include at least the following sequences:
      a. Start-up.
      b. Normal operating mode.
      c. Unoccupied mode.
      d. Shutdown.
      e. Capacity control sequences and equipment staging.
      f. Detailed sequences for all control strategies.
      g. Sequences for all alarms and emergency shut downs.
      h. Interactions and interlocks with other systems.
   3. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
   4. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged controls and the control system, indicating which points are adjustable control points and which points are only monitored.
   5. Include operating schedules.

C. Hand-Off-Auto function: HOA switch may be provided by the equipment manufacturer, by Division 26, or as part of a speed control unit (VFD).
   1. When furnished integral with equipment, manufacturer shall determine HOA functionality.
   2. When HOA function is provided with the VFD, or is furnished and installed by Division 26:

a. In Hand position, system shall be under manual control.
b. In Off position, system shall be in the Safety default position.
c. In Auto position, system shall be under the control of the BMCS.

D. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
1. Label with settings, adjustable range of control and limits.
2. Include flow diagrams for each control system, graphically depicting control logic.
3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Include preliminary graphic displays indicating mechanical system components, control system components, and controlled function status and value.
5. Include a key to abbreviations.

E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 DOMESTIC WATER RECIRCULATING PUMP**

A. Domestic Water Recirculating Pump
1. Aquastat starts pump on temperature drop below setpoint (105 degrees F).

**3.02 DOMESTIC WATER BOOSTER PUMP**

A. Domestic Water Booster Pump
1. Pressure sensor starts the pump, when the pressure is below 70 PSI. The pump shall stop, when the pressure sensor reaches 80 PSI.

**END OF SECTION**

**SECTION 221005**

**PLUMBING PIPING**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Pipe and pipe fittings for:
   1. Water service.
   2. Domestic water.
   3. Irrigation piping.
   4. Sanitary sewer.
   5. Sanitary vent.
   6. Kitchen sanitary waste.
   7. Storm water.
   7. Deck drainage collector piping.

B. Miscellaneous accessories:
   1. Pipe sleeves.
   2. Link seals.
   3. Escutcheon plate.
   4. Unions and flanges.
   5. Strainers.

### 1.02 RELATED DOCUMENTS

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

B. Section 078413 – Penetration Firestopping.

C. Section 220519 – Meters and Gauges for Plumbing Piping.

D. Section 220523 – General Duty Valves for Plumbing Piping.

E. Section 220529 – Hangers and Supports for Plumbing Piping and Equipment.

F. Section 220553 – Identification for Plumbing Piping and Equipment.

G. Section 220719 – Plumbing Piping Insulation.

H. Section 221006 – Plumbing Piping Specialties.

I. Section 223000 – Plumbing Equipment.

J. Section 224000 – Plumbing Fixtures.

### 1.03 REFERENCES

A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

D. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; The American Society of Mechanical Engineers; 1988.

E. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).

F. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2004a.

G. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; latest edition.

H. ASTM A 234 - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2004.

I. ASTM A 888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; latest edition, including annex A1.

J. ASTM B 32 - Standard Specification for Solder Metal; 2004.

K. ASTM B 42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2002.

L. ASTM B 88 - Standard Specification for Seamless Copper Water Tube; 2003.

M. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2003a.

N. ASTM D 2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems; 2004.

O. ASTM D 2665 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2004a.

P. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2002).

Q. ASTM D 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2004a.

R. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 ANSI/AWWA C651).

S. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; Cast Iron Soil Pipe Institute; 2005 edition.

T. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; Cast Iron Soil

Pipe Institute; latest edition.

**1.04 DESCRIPTION OF WORK**

A. Furnish complete piping systems for the following:
   1. Potable water.
   2. Sanitary waste.
   3. Sanitary vent.
   4. Storm drainage.
   5. Lawn irrigation piping inside building.

B. Provide all hangers and supports as required.

C. Make connections to all equipment, fixtures and devices.

**1.05 SUBMITTALS**

A. Comply with requirements of Division 1.

B. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information.

**1.06 QUALITY ASSURANCE**

A. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

B. Welders Certification: In accordance with ASME (BPV IX).

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

**1.07 ENVIRONMENTAL REQUIREMENTS**

A. Do not install underground piping when bedding is wet or frozen.

**PART 2 PRODUCTS**

**2.01 SANITARY WASTE**

A. Underground (Within building to 5'-0" from building)

   1. Pipe - No-hub, cast iron, service weight, ASTM A888 and CISPI 301
   2. Fittings - No-hub, cast iron, DWV, ASTM A888 and CISPI 301
   3. Joints - Elastomeric sleeve, stainless cover, stainless clamps, ASTM C1277 and CISPI 310

B. Above Ground

   1. Pipe - No-hub, cast iron, service weight, ASTM A888 and CISPI 301
   2. Fittings - No-hub, cast iron, DWV, ASTM A888 and CISPI 301
   3. Joints - Elastomeric sleeve, stainless cover, stainless clamps, ASTM C1277 and CISPI 310

C. Commercial Kitchen Waste

1. Above Ground
   a. Pipe - High silicone cast iron, duriron
   b. Fittings - High silicone cast iron, duriron
   c. Joints - Mechanical coupling with continuous one-piece, sintered, non-porous liner, neoprene outer sleeve and stainless steel clamp.

2. Underground (Within Building)

   a. Pipe - High silicone cast iron, duriron
   b. Fittings - High silicone cast iron, duriron
   c. Joints - Mechanical coupling with continuous one-piece, sintered, non-porous liner, neoprene outer sleeve and stainless steel clamp.

**2.02 SANITARY VENT**

A. Aboveground - Within building

1. Pipe - No-hub, cast iron, service weight, ASTM A888 and CISPI 301
2. Fittings - No-hub, cast iron, DWV, ASTM A888 and CISPI 301
3. Joints - Elastomeric sleeve, stainless cover, stainless clamps, ASTM C1277 and CISPI 310

**2.03 STORM**

A. Underground (Within building to 5'-0" from building)

1. Pipe - No-hub, cast iron, service weight, ASTM A888 and CISPI 301
2. Fittings - No-hub, cast iron, DWV, ASTM A888 and CISPI 301
3. Joints - Elastomeric sleeve, stainless cover, stainless clamps, ASTM C1277 and CISPI 310

B. Above Ground

1. Pipe - No-hub, cast iron, service weight, ASTM A888 and CISPI 301
2. Fittings - No-hub, cast iron, DWV, ASTM A888 and CISPI 301
3. Joints - Elastomeric sleeve, stainless cover, stainless clamps, ASTM C1277 and CISPI 310

**2.04 DOMESTIC WATER SERVICE**

A. Underground - (From 5'-0" outside of building)

1. Pipe - Ductile iron, ANSI A21.51 (AWWA C151)
2. Fittings - Ductile iron
3. Joints - Mechanical with threaded rod flange and rubber gasket

B. Underground - (5’-0” outside of building to 6” above floor at service entrance)

1. Pipe - Ductile iron, ANSI A21.51 (AWWA C151)
2. Fittings - Ductile iron

3. Joints - Mechanical with threaded rod flange and rubber gasket

**2.05 DOMESTIC WATER SYSTEM (WITHIN BUILDING) - COPPER**

A. Hot, Cold Distribution, Recirculating Hot Water, Tempered Water

1. Pipe - Copper, Type L, ASTM B88, hard drawn, soft drawn may be used next to fixtures
2. Fittings - Wrought copper, brass or cast bronze
3. Joints - Screwed or pressure type with 95/5 solder and non-corrosive flux

**2.06 RELIEF PIPING AND KITCHEN INDIRECT WASTE PIPING**

A. Pipe - Copper, Type M, hard drawn

B. Fittings - Cast bronze or wrought copper

C. Joints - Pressure type with 95/5 solder

**2.07 POOL DECK DRAINAGE COLLECTOR PIPING AND FITTINGS**

A. Pipe - PVC, ASTM D2665 or ABS ASTM D2661
B. Fittings - PVC or ABS, socket type, DWV, NSF Standard 14
C. Joints - Solvent weld. PVC joints shall be prepared with contrasting color primer.

**2.08 PIPE SLEEVES**

A. Floor sleeves shall be uncoated or galvanized steel pipe not less than Schedule 40.

B. Sleeves in rated walls shall be as required for U. L. listing.

C. Temporary sleeves in poured concrete walls or floors shall be poly-sleeve with nailing flange.

**2.09 EXTERIOR WALL LINK SEALS**

A. Modular type consisting of synthetic rubber links with threaded rods and nuts. Temperature rating -40 to 250 degrees.

B. Acceptable Manufacturer:
1. Link Seal, Thunderline Corporation

**2.10 FLOOR, WALL AND CEILING ESCUTCHEON PLATES**

A. Escutcheon plates shall be at least 1/32" thick and shall be equipped with set screws for locking around pipe. Plates shall be finished steel chromium plated.

**2.11 FLANGES, UNIONS, AND COUPLINGS**

A. Unions for Pipe Sizes 2 Inches and Under:
1. Ferrous pipe: Class 150 malleable iron threaded unions.
2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes 2-1/2 Inches and Larger:

1. Ferrous pipe: ASTM A 181, Class 150 forged steel slip-on weld flanges; preformed neoprene gaskets.
2. Copper pipe: Class 150 companion bronze flanges; preformed neoprene gaskets.

**2.12 DIELECTRIC UNIONS AND FLANGES**

A. All 2" and smaller copper piping connections to a dissimilar metal shall be made with insulated type dielectric unions or flanges.

B. All 2-1/2" and larger copper piping connections to a dissimilar metal shall be made with insulated dielectric flange kits. Dielectric flange kit shall consist of a 1/8" phenolic retainer with a Viton sealing ring. Provide one phenolic sleeve and two 1/8" phenolic washers and two 1/8" galvanized steel washers for each bolt.

C. Dielectric flange kits shall be Class 150 rated at 175 psig and conform to ANSI B16.42 and B16.24.

**2.13 STRAINERS**

A. All strainers shall be Y type cast bronze Class 250 with stainless steel screen.

B. Strainers shall be full line size.

C. Acceptable Manufacturers:
1. Mueller 352M
2. Dunham-Bush
3. Hoffman 420C
4. Armstrong

**PART 3 EXECUTION**

**3.01 INSTALLATION - GENERAL REQUIREMENTS**

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

E. Install piping to maintain headroom, conserve space, and not interfere with use of space.

F. Provide a sleeve set with water stop plate at all exterior wall penetrations, sleeve shall be minimum schedule 40 galvanized steel pipe. Sleeve inside diameter shall encompass pipe and link seal. Provide link seal as described in Part 2, Products.

G. Group piping whenever practical at common elevations.

H. Where uncovered, exposed pipes pass through walls, floors or ceilings, they shall be fitted with escutcheon plates. Plates shall be set tight against wall or floor. Plates on other than exposed pipes shall be prime coated.

I. Make connections to all equipment, fixtures and devices.

**3.02 DOMESTIC WATER SERVICE**

A. Provide (water service / combined service) (and fire service) piping extending from location 5'-0" outside the building to point up to and including the service entrance flange inside the building.

B. Provide a tee for connection of the both fire sprinkler system and the domestic water systems when served by a combined service.

C. Provide reaction blocking, or other approved joint restraint, at all changes in direction for underground ductile iron water service and/or fire service piping. Sizing and installation shall comply with procedures described in AWWA Standard C600.

**3.03 DOMESTIC WATER DISTRIBUTION**

A. Install water piping to ASME B31.9.

B. Provide domestic hot and cold water to all outlets and fixtures as shown on drawings or specified herein.

C. All water piping shall be pitched to drain points and up from hot water tanks, supply mains or risers 1/8" per ten feet wherever possible.
   1. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
   2. Install valves with stems upright or horizontal, not inverted.

D. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

E. Install unions downstream of valves and at equipment or apparatus connections.

F. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

G. Install ball valves for shut-off and to isolate equipment bypass, part of systems, or vertical risers.

H. Provide drain valves at base of all risers and at all low points in piping.

**3.04 WASTE AND VENT PIPING**

A. The continuous waste and vent piping method shall be followed for the entire plumbing system.

B. All waste and vent piping less than 3" shall be pitched at 1/4" to the foot minimum. Waste and vent piping 3" and larger shall be pitched 1/4" to the foot where possible and 1/8" minimum unless indicated otherwise so that all waste piping will drain back to main stacks and vent pipe will drain back to fixture. Piping shall be properly supported so that it will not sag and form pockets.

C. Double wye drainage fittings shall not be installed in the horizontal position.

D. Install vent piping penetrating roofed areas to maintain integrity of roof assembly. Vent stacks shall be extended at least 12" above roof in frost proof jackets. Size of vents passing through roof shall be as shown on plan with a minimum size being 2". Roof jackets shall not be placed less than 4'-0" from edge of roof. Vent outlets shall be located a minimum of 10'-0" horizontally from any ventilation opening.

E. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

F. Each building drain shall be provided with at least one full size 3" vent stack or stack vent carried full size through the roof.

G. Installation, support, and bracing of sanitary sewer piping shall comply with the installation procedures described in CISPI 301 and CISPI 310. In no case shall hanger support spacing be a dimension less than as required by code.

**3.05 STORM PIPING**

A. All gravity drainage storm piping shall be pitched at 1/8" per foot minimum unless indicated otherwise. Piping shall be properly supported so that it will not sag and form pockets.

B. Double wye drainage fittings shall not be installed in the horizontal position.

C. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

D. Installation, support, and bracing of storm sewer piping shall comply with the installation procedures described in CISPI 301 and CISPI 310. In no case shall hanger support spacing be a dimension less than as required by code.

**3.06 FLASHINGS**

A. Install flashings at all cleanouts, roof drains, floor drains, floor sinks, and area drains.

**3.07 PIPE SLEEVES**

A. Provide sleeves for all piping as follows:
   1. Floor slabs above grade.
   2. Exposed finished areas.
   3. Fire rated or acoustical walls.
   4. Exterior walls.
   5. CMU walls.

B. Sleeves shall be a minimum of 1" greater in inside diameter than piping or insulated piping passing through sleeve.

C. Fabricate all pipe sleeves of new material, cut square and reamed.

D. All sleeves through walls, extend full thickness of wall, cut flush with finished surfaces.

E. Permanent sleeves for copper or cast iron piping through floor slabs for piping, shall extend 2" above finished floor. Sleeves shall extend 4" above the floor in mechanical room, laundry and/or kitchens. All sleeves shall be bonded to the slab with an epoxy bonding material.

F. Pack space between pipe and all sleeves. Packing material shall be as described in Specification Section 078413.

G. Provide fire stop assembly at the base of the slab at PVC pipe penetrations, pack space between pipe and floor slab with packing material, provide epoxy bonding material at finish floor, provide pipe clamp to support pipe riser.

H. In locating and setting sleeves, this Contractor is to leave a minimum of 4" between sleeves in rows or clusters. Where the normal spacing of top and bottom reinforcing bars cannot be maintained or the bars are interrupted because of sleeves size or cluster location, provide extra reinforcing bar as specified elsewhere around the clusters or sleeves as approved by Architect or Engineer.

**3.08 RELIEF PIPING**

A. Pipe all relief valve discharge to floor drain.

B. Pipe discharge shall be located to allow safe access to equipment should discharge occur.

**3.09 KITCHEN INDIRECT WASTE PIPING**

A. Provide indirect waste piping for all kitchen equipment except piping noted on the kitchen equipment drawings as provided by Division 11.

B. Equipment and fixtures used for the storage, preparation, and handling of food or drink shall discharge through indirect waste piping to the sanitary sewer by means of an air gap.

C. Indirect waste piping shall be a minimum of 1" diameter regardless of connection size.

D. Indirect waste piping shall be pitched downward.

E. Provide sufficient cleanouts to allow the entire indirect waste piping system to be cleared of blockages.

**3.10 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM**

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain chlorine residual of not less than 50 parts per million.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 parts per million, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 0.2 parts per million.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

## 3.12 CLEANING

A. Cleaning
   1. Remove temporary coverings and protection of adjacent work areas.
   2. Repair or replace damaged installed products.

B. Protection
   1. Protect installed work from damage due to subsequent construction activity on the site.

## 3.13 PLUMBING TESTS

A. The underground water service piping system testing and acceptance procedures shall be performed. The Division 22 is responsible to make all necessary corrections as required if leaks are found during testing. Testing procedures shall be as described below unless otherwise required by Code.

B. Domestic Water: Water piping shall be tested hydrostatically at 125 psig or 1-1/2 times the operating pressure, whichever is greater, for a period of two hours prior to application of pipe insulation and final connection to fixtures.

C. Sanitary and Rainwater Systems - Rough-in: All interior storm, sanitary and vent piping shall be tested with air at 5 psig for a period of not less than 15 minutes. The pressure shall remain constant without the addition of air.

D. Sanitary Systems - Final: Upon installation of fixtures and filling of fixture traps, the roof and building drain openings shall be sealed and the system subjected to a manometer test. The system shall maintain a pressure differential of 1" of water column for a period of not less than 15 minutes. The pressure shall remain constant without the addition of air.

**END OF SECTION**

**SECTION 221006**

**PLUMBING PIPING SPECIALTIES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Thermostatic Mixing Valves.

B. Backflow Preventers.

C. Water Pressure Reducing Valves.

E. Water Temperature and Pressure Relief Valves.

F. Hydrants and Hose Bibbs.

G. Water Filters.

H. Cleanouts.

I. Floor Drains.

J. Roof Drains.

K. Roof Jackets.

L. Drain Flashing.

M. Pool Deck Drains

### 1.02 RELATED DOCUMENTS

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

B. Section 221005 - Plumbing Piping.

C. Section 224000 - Plumbing Fixtures.

D. Section 223000 - Plumbing Equipment.

### 1.03 REFERENCES

A. ASSE 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1011).

B. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering; 2004 (ANSI/ASSE 1019).

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

### 1.05 DELIVERY, STORAGE, AND PROTECTION

A. Accept specialties on site in original factory packaging. Inspect for damage.

### 1.06 REGULATORY REQUIREMENTS

A. Perform Work in accordance with State plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

## PART 2 PRODUCTS

### 2.01 THERMOSTATIC HI-LOW MIXING VALVES

A. Thermostatic Mixing Valve
   1. Bronze body.
   2. Mixing valve shall be capable of delivering at least 15 GPM at a temperature between 60 degrees F and 120 degrees F with pressure drop 10 PSI or less.
   3. 3/4” hot and cold inlet, 3/4” tempered outlet.
   4. Field adjustable outlet temperature.
   5. Mixing valve shall be capable of operating down to a flow rate of at least 2 GPM.
   6. Mixing valve shall include thermometer to display mixed water temperature.
   7. Assembly shall comply with ASSE Standard 1017.
   8. Acceptable Manufacturers:
      a. Bradley
      b. Lawler
      c. Leonard
      d. Powers

### 2.02 ATMOSPHERIC VACUUM BREAKERS

A. Atmospheric vacuum breaker designed to prevent back siphonage of contaminated water into a safe drinking water supply. See Part 3 for approved applications.

B. Manufacturer: Standard type:
   1. Watts No. 288A
   2. Chicago No. 982

3. Febco 710/715
4. Wilkins 35.

C. Manufacturer; Flush valve type:
1. Automatic type as furnished by flush valve manufacturer.

**2.03 PRESSURE VACUUM BREAKERS**

A. Pressure vacuum breaker designed to prevent back siphonage of contaminated water into a safe drinking water supply. See Part 3 for approved applications.

B. Acceptable Manufacturers:
1. Watts 800M4QT or 008QT (low spill model)
2. Febco Model 765.
3. Wilkins 720A

**2.04 DOUBLE CHECK VALVE WITH INTERMEDIATE ATMOSPHERIC VENT**

A. Backflow preventer designed for connections to low hazard equipment with continuous line pressure or backpressure. See Part 3 for approved applications.

B. Acceptable Manufacturers:
1. Watts
2. Febco
3. Wilkins

**2.05 REDUCED PRESSURE ZONE BACKFLOW PREVENTER**

A. Backflow preventer designed for connections to high hazard equipment with continuous line pressure or backpressure. See part 3 for approved applications. Reduced pressure principal style with two independent check valves with intermediate relief valve, shut-off valves and ball type test cocks, and air gap.

B. Acceptable Manufacturers:
1. Watts
2. Febco
3. Wilkins
4. Conbraco Industries

**2.06 WATER HAMMER ARRESTORS**

A. Stainless steel shell, elastomer or stainless steel nested bellows.

B. Arrestor sizing and installation shall conform to Standard PDI-WH201.

C. Size shall be adequate to handle fixtures served, see schedule listed in Part 3.

D. Acceptable Manufacturers:
1. Josam
2. Wade
3. Zurnl
4. Smith
5. Sioux Chief

**2.07 WATER PRESSURE REDUCING VALVE**

A. Pressure reducing valve body shall be bronze with the entire assembly suitable for potable water service. Seats shall be renewable bronze, nickel alloy or stainless steel. Springs, diaphragm, and disk shall be renewable without requiring valve body to be removed from piping. All welded working parts shall be bronze or stainless steel except for the diaphragm. Valve setting shall be field adjustable. Valve shall be rated for inlet pressure as scheduled.

B. Acceptable Manufacturers:
   1. Watts Model 223
   2. Wilkins 500

**2.08 WATER PRESSURE TEMPERATURE RELIEF VALVE**

A. Fully automatic temperature and pressure relief.

B. Bronze body non-mechanical seat to disk alignment.

C. ASME Rated, ANSI Z21.22

D. Acceptable Manufacturer:
   1. Watts

**2.09 HYDRANTS AND HOSE BIBBS**

A. Wall Hydrants – Exterior, Standard Outlet
   1. Non-freeze, automatic draining, loose-key stop, 3/4" threaded outlet.
   2. Integral vacuum breaker.
   3. Manufactured to ASSE standard 1019.
   4. Wall hydrant shall be suitable for wall thickness encountered.
   5. Acceptable Manufacturers:
      a. Wade
      b. Woodford
      c. Josam
      d. Zurn
      e. Smith
      f. Prier

**2.10 INLINE WATER FILTER**

A. Inline cartridge water filter with clear 12” high, Styrene-Acrylonitrile (SAN) housing. 3/4" NPT inlet and outlet ports.

B. 4 PSI flow loss at 5 GPM.

C. Coordinate locations with the Owner.

D. Manufacturers:
   1. Coordinate with the Owner.

**2.11 CLEANOUTS**

A. Finished Floors:

1. Coated cast iron body, internal gasketed ABS plug, adjustable top assembly with secured scoriated satin Nikaloy round cover. Furnish recessed cover for vinyl tile floor and square top for quarry or ceramic tile floor. Carpeted floors shall use carpet markers.
2. Acceptable Manufacturers:
   a. Wade W-7000
   b. Josam 56000 Series
   c. Zurn Z-1400
   d. Smith 4020 and 4140 Round

B. Equipment Rooms and Heavy Traffic Areas
1. Coated cast iron body, tapered threaded ABS plastic plug and adjustable top assembly with heavy duty cast iron tractor cover.
2. Acceptable Manufacturers:
   a. Wade W-7000- Z
   b. Josam 56050
   c. Zurn Z-1400- HD
   d. Smith 4240

C. Covers for Walls and Ceilings - Finished Areas
1. Square access cover with chrome plated top, anchor lugs and coverplate secured with screws.
2. Acceptable Manufacturers:
   a. Wade
   b. Josam
   c. Zurn
   d. Smith

D. Covers for Walls and Ceilings - Unfinished Areas
1. Round polished stainless steel access coverplate with countersunk screws.
2. Acceptable Manufacturers:
   a. Wade
   b. Josam
   c. Zurn
   d. Smith

## 2.12 FLOOR DRAINS AND AREA DRAINS

A. Finished Areas
1. Body - coated cast iron, bottom caulked or no-hub outlet, drainage flange, weep holes, flashing collar.
2 Strainer - 6" round, threaded adjustable height, satin nickel finish.
3. Acceptable Manufacturers:
   a. Wade
   b. Josam
   c. Smith
   d. Zurn

B. Equipment Rooms
1. Body - coated cast iron, bottom caulked or no-hub outlet, drainage flange, weep holes, flashing collar.
2. Strainer - 9" round, medium duty, ductile iron, tractor type grate.

3. Acceptable Manufacturers:
   a. Josam
   b. Smith
   c. Zurn

## 2.13 ROOF DRAINS

A. Conventional Roof Drain
   1. Body – lacquer coated cast iron, bottom caulked or no-hub outlet, large sump, roof flange.
   2. Dome - aluminum dome with clamping ring and gravel stop.
   3. Provide with under deck clamp and extensions for insulation encountered.
   4. Assembly ASME A112.6.4.
   5. Accessories: Coordinate with roofing type.
      a. Membrane flange and membrane clamp with integral gravel stop.
      b. Adjustable under deck clamp.
      c. Roof sump receiver.
      d. Waterproofing flange.
      e. Leveling frame.
      f. Adjustable extension sleeve for roof insulation.
   6. Acceptable Manufacturers:
      a. Wade
      b. Josam
      c. Smith
      d. Zurn

C. Overflow Roof Drain
   1. Same as above except with 2” internal water dam.

D. Downspout Nozzle
   1. Body - cast bronze nozzle, loose wall flange, threaded inlet
   2. Finish - rough bronze.
   3. Acceptable Manufacturers:
      a. Wade
      b. Josam
      c. Smith
      d. Zurn

## 2.14 ROOF JACKETS

A. Vent stacks for sewer, soil waste and drain lines shall be extended at least 12" above roof and shall be encased in frost proof jackets, Moore, Sure Seal or equal, each having an air space of at least 1" between the outside surface of pipe and inside surface of frost jacket. The top of the frost jackets shall be designed as to permit the insertion therein of a testing plug of such form that it can be readily seen until removed and said plug shall be removed at once after a final inspection has been made and approved by Engineer.

B. Roof jackets shall be constructed of 14 gauge galvanized iron for all sizes 6" and smaller, or factory molded rubber pipe seals with stainless steel clamps as per manufacturer's recommendations, Goodyear or approved equal.

## 2.15 DRAIN AND CLEANOUT FLASHING

A. Chloraloy polyethylene laminated flashing. Flashing shall be a minimum of 32" x 32".

**2.16 LINEAR SLOT POOL DECK DRAINS**

A. Linear slop deck drainage system shall NSF Standard 50 approved for pool installations. Construction shall be PVC with removable PVC top caps. Width of top cap shall be approximately 1-3/4" wide.

B. Colors available shall be white, tan, black or grey with final color selection by Architect.

C. System shall be selected and configured to integrate with separate deck drain collector piping system. Provide all necessary joints, fittings, adapters, retaining hardware, etc. to provide complete deck drainage configuration.

D. Acceptable Manufacturer: NDS, Stegmeier, or approved equal.

**PART 3 EXECUTION**

**3.01 VACUUM BREAKERS**

A. All vacuum breaker installations shall comply with code requirements.

B. Install vacuum breakers at threaded hose connections, potable water fill connections and where indicated on the drawings. Do not install vacuum breakers on water connections to pressurized systems or systems which could exert back pressure on the vacuum breaker.

C. Vacuum breakers shall be provided integral with each flush valve and tank water closet fill valve.

D. Atmospheric vacuum breakers shall be installed 6" minimum above the spill line of the fixture or equipment served. Shut off valves which create line pressure on both sides of the vacuum breaker are not allowed downstream of an atmospheric vacuum breaker.

E. Pressure vacuum breakers shall be installed 12" minimum above the spill line of the fixture or equipment served. Shut off valves are allowed on the downstream side of a pressure vacuum breaker.

**3.02 DOUBLE CHECK VALVE WITH INTERMEDIATE ATMOSPHERIC VENT**

A. All installations shall comply with code requirements.

B. Install on where indicated on drawings and on potable water connections to low hazard equipment which may be subject to backpressure making a vacuum breaker unsuitable. Low hazard equipment includes ice machines, coffee machines, and similar food and beverage equipment.

C. Pipe drain and discharge with air gap to nearest floor drain.

**3.03 REDUCED PRESSURE ZONE BACKFLOW PREVENTERS**

A. All installations shall comply with code requirements.

B. Install on potable water connections to the hot water heating, chilled water, condenser water, or similar pressurized systems where toxic chemicals may be introduced. Install at all additional locations indicated on the drawings.

C. Mount at between 12” and 60” above finished floor.

D. Pipe drain and discharge with air gap to nearest floor drain.

E. Provide isolation valves on the inlet and discharge side of the backflow preventer to allow for servicing.

F. The installing contractor shall notify the owner of the following: The installation of reduced pressure zone backflow preventers is permitted only when periodic testing is done by a trained backflow preventer tester acceptable to the administrative authority. Testing intervals shall not exceed one year, and records must be kept. All devices must be tested after initial installation to assure that debris from the piping installation has not interfered with the functioning of the device. The devices shall be overhauled at least once every five years.

**3.04 CLEANOUTS**

A. Cleanouts, placed in accessible locations, shall be provided on all storm and sanitary drainage piping where indicated on the drawings, as required by Code, as specified herein, and where necessary to permit rodding of entire drainage system.

B. Cleanouts shall be provided at each change of direction greater than 45 degrees in the building sewer, building drain, horizontal soil, and horizontal waste lines.

C. Cleanouts shall be installed on the building and storm sewer within the building immediately near the building drain and storm sewer exits from the building.

D. Cleanouts shall be provided at the base of each soil or waste stack and at the base of each rainwater leader.

E. Cleanouts shall be placed at 50 foot maximum intervals in horizontal runs for piping 3" or less and 100 foot maximum intervals for piping 4" and over.

F. Cleanouts on piping installed in inaccessible furred spaces, above inaccessible ceiling, or below floor on grade shall be provided with extensions to bring cleanout cover flush with finished wall or floor. Cleanouts in floors with waterproof membrane shall be furnished with flange and suitable clamp device.

G. Cleanouts shall be of the same nominal size as the pipes they serve up to 4” in diameter and not less than 4” in diameter for larger piping.

H. Each horizontal drain branch shall be provided with a cleanout at its upper terminal, except that a fixture with a removable trap or a fixture with an integral trap, readily removable without disturbing concealed piping, may be considered a cleanout equivalent.

I. All floor set fixture drains with concealed traps, such as floor drains and trench drains, that receive fouling waste shall be provided with an integral cleanout or a cleanout shall be installed as close as possible to the drain on the horizontal fixture branch serving the drain. The cleanout shall be the same size as the horizontal fixture branch.

J. A floor drain cleanout may be omitted if the floor drain or fixture branch line is less than 5'-0" in length.

K. A trap opening from a lavatory, drinking fountain, urinal, sink or similar fixture may serve as a cleanout for a horizontal branch drain up to two inches in size, if the drain opening is not more than one pipe size smaller than the horizontal branch drain.

L. A cleanout shall be provided on a common vertical fixture drain or common vent serving two fixture traps that connect to a vertical drain at the same level. The cleanout shall be the same nominal pipe size as the drain serving the fixtures. Where the vertical drain is accessible through the trap opening, the cleanout may be eliminated.

M. Floor drains used for shower drains, recessed slop, or similar receptors may have the full sized cleanout installed on the individual vent pipe serving the fixture or on the fixture.

**3.05 FLOOR DRAINS**

A. Provide p-trap for all floor drains.

B. Install floor drains without backwater valves on all tell-tale drains in kitchens.

**3.06 ROOF DRAINS AND DOWNSPOUT NOZZLES**

A. Pipe overflow rain water leaders to downspout nozzle, mount 18" above grade. Provide concrete splash block. Coordinate location to discharge clear of sidewalks or pedestrian crossings.

**3.07 ROOF JACKETS**

A. Vent stacks from sewer, soil, waste and drain lines shall be extended at least 12" above roof in frost proof jackets. Size of vents passing through roof shall be as shown on plan with a minimum size being 2". Roof jackets shall not be placed less than 4'-0" from edge of roof. Vent outlets shall be located a minimum of 10’-0” horizontally from any ventilation opening.

**3.08 FLASHINGS**

A. Install flashings at all cleanouts, roof drains, floor drains, floor sinks, and area drains.

**3.09 HYDRANTS AND HOSE BIBBS**

A. Each exterior hydrant shall be provided with a stop and waste valve on the supply to the hydrant.

B. Exterior hydrants shall be installed with the center of the outlet 18" above the adjacent grade unless otherwise detailed or noted on drawings.

C. Interior hose bibbs shall be installed with the center of the outlet 36" above finished floor unless otherwise detailed or noted on drawings.

**END OF SECTION**

**SECTION 221123**

**NATURAL GAS PIPING**

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, hangers, supports, and connections for natural gas piping systems.

### 1.02 RELATED 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.

B. Section 223000 – Plumbing Equipment

C. Section 220529 – Hangers and Supports for Plumbing Piping and Equipment

D. Section 220553 – Identification for Plumbing Piping and Equipment

E. Section 237313 – Packaged Outdoor Central-Station Air-Handling Units

### 1.03 REFERENCES

A. ANSI B36.10 – Carbon, Alloy and Stainless Steel Pipes; The American National Standards Institute.

B. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).

### 1.04 DESCRIPTION OF WORK

A. Work under this section includes the furnishing of all equipment, piping, hangers, valves, unions, etc. to make the following systems complete and operating.
   1. Natural gas

B. Make connections to all equipment.

C. Provide all necessary gas pressure regulators.

D. Provide all necessary gas regulator vent piping.

### 1.05 SUBMITTALS

A. Comply with Division 00 and 01 – Submittal Procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of all valves and note on drawings any deviations from the contract documents.

## PART 2 - PRODUCTS

### 2.01 VALVES - NATURAL GAS

A. Isolation and shut-off
   1. Pipe sizes 4" and smaller, cast iron body, bronze or nickel plated cast iron eccentric plug, HYCAR plug seal, screwed ends, U.L. listed. Manufacturer: DeZurik 425 RS 49.
   2. Alternate valve. Bronze body ball valve, lever handle, solder or screwed ends, teflon seats and seal, 300 lb. WOG or minimum at 275 degrees F. Manufacturer: Apollo Series 80, Crane 2330 FT, Contromatics 11000-AA, Lunkenheimer 700 ST or 722 ST, Wochester 411T.

B. Gas Pressure Regulators
   1. Full lock-up with vent limiting device to limit the escape of gas from the vent opening in the event of diaphragm failure.
   2. Pressure regulators shall be sized to deliver the quantity of gas required by the equipment with an inlet pressure of 2 psi and an outlet pressure required by the equipment.

### 2.02 PIPE AND PIPE FITTINGS

A. Natural Gas
   1. Pipe - (Indoor)
      a. Schedule 40 thickness black steel (ANSI B36.10)
   2. Fittings - (Indoor)
      a. 2-1/2" and larger - Black steel, schedule 40, welded.
      b. 2" and smaller - Black steel, screwed then welded or malleable iron to be used with schedule 40 black steel piping.
   3. Pipe - (Outside Above Ground)
      a. 2-1/2" and larger - Schedule 40 thickness black steel (ANSI B36.10), finish with rust inhibitive primer and paint.
      b. 2" and smaller - Schedule 40 thickness black steel (ANSI B36.10), finish with rust inhibitive primer and paint.
   4. Fittings (Outside Above Grade)
      a. 2-1/2" and larger - black steel, schedule 40, welded, primed and painted.
      b. 2" and smaller - Malleable iron, screwed, primed and painted

### 2.03 PIPE SLEEVES

A. Floor sleeves shall be uncoated or galvanized steel pipe not less than Schedule 40.

B. Sleeves in rated walls shall be as required for U. L. listing.

C. Temporary sleeves in poured concrete walls or floors shall be poly-sleeve with nailing flange.

### 2.04 FLOOR, WALL AND CEILING ESCUTCHEON PLATES

A. Escutcheon plates shall be at least 1/32" thick and shall be equipped with set screws for locking around pipe. Plates shall be finished steel chromium plated.

## PART 3 - EXECUTION

### 3.01 NATURAL GAS PIPING

A. Gas piping shall be installed with drip legs and unions at all regulators and equipment connections.

B. Maintain minimum 4" straight run between changes in direction.

C. Follow fuel gas piping manufacturer's installation instruction on joint preparation, adhesive application and curing.

D. Gas piping installed between appliance gas pressure regulators and the appliance shall not be more than 10'-0" in length and shall at a minimum be the same size as the appliance connection.

E. For gas pressure regulators that require venting, provide vent piping from the regulator and extend to the building exterior to an approved location.

**3.02 PIPE SLEEVES**

A. Provide sleeves for all piping as follows:
   1. Precast slabs.
   2. Exposed finished areas.
   3. Fire rated or acoustical walls.
   4. Exterior walls.
   5. CMU walls.

B. Sleeves shall be a minimum of 1” greater in inside diameter than piping or insulated piping passing through sleeve.

C. Fabricate all pipe sleeves of new material, cut square and reamed.

D. All sleeves through walls extend full thickness of wall, cut flush with finished surfaces.

E. Permanent sleeves for steel piping through floor slabs for piping, shall extend 2" above finished floor. Sleeves shall extend 4" above the floor in mechanical room, laundry and/or kitchens. All sleeves shall be bonded to the slab with an epoxy bonding material.

F. Pack space between pipe and all sleeves.

G. In locating and setting sleeves, this Contractor is to leave a minimum of 4" between sleeves in rows or clusters.

**3.03 PIPE HANGERS AND SUPPORTS**

A. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding
   7. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

8. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
9. Supports shall be sized for weights and pipe sizes encountered.
10. Supports shall properly compensate for all thermal expansion and contraction.

B. Floor, wall and ceiling escutcheon plates
1. Where uncovered, exposed pipes pass through walls or floors, they shall be fitted with wall or floor plates.
2. Plates shall be set tight against wall or floor. Plates on other than exposed pipes shall be prime coated.

C. Horizontal Hanger Spacing Schedule
1. Steel Pipe

| Pipe or Tube Size | Hanger Spacing | Minimum Rod Diameter |
|---|---|---|
| 1/2" tube only | 6' | 1/4" |
| 1/2" - 1" | 8' | 3/8" |
| 1-1/4" - 1-1/2" | 10' | 3/8" |
| 2" | 10' | 1/2" |

D. Roof Pipe Supports
1. Remove loose aggregate from built-up or ballasted membrane roof area beneath pipe stand.
2. Place traffic pad at pipe support location and locate pipe stand on pad.

**3.04 VALVES**

A. Shutoff valves shall be located in places so as to provide access for operation and shall be protected from damage.

B. Provide shut off valves on both the supply side and the discharge side of the gas meter.

C. Interior piping systems shall be provided with an approved main shutoff valve before the first branch line. The main shut off valve shall be installed in the first available location inside the building that provides ready access and shall have a permanently attached handle.

D. Exterior roof piping systems shall be provided with an approved main shutoff valve installed 10 feet or more from the roof edge and before the first branch line.

E. Each appliance shall be provided with a shutoff valve separate from the appliance. The shutoff valve shall be located in the same room as the appliance and shall not be further than 6 feet from the appliance.

F. Shutoff valves for decorative vented appliances, such as fireplaces, may be installed in an area remote from the appliance. Such valve shall be permanently labeled, shall serve no other equipment, and shall be readily accessible.

G. For piping systems serving multiple tenant buildings, each tenant shall have an individual valve to control the piping to the tenant space. This valve shall be readily accessible by the tenant.

H. For piping systems serving multiple tenant buildings, unless otherwise waived by the building official, a main shut off valve shall be located in a common unlocked utility room or similar space that provides ready access for all tenants.

I. Provide plug valves in natural gas systems for shut-off service.

**3.05 SERVICE CONNECTIONS**

A. Provide new gas service complete with gas meter and regulators. Gas service distribution piping to have initial minimum pressure of 2 psi. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

**3.06 IDENTIFICATION**

A. All black steel gas piping shall be identified every 50 feet, on both sides of wall or floor penetration, and at every change of direction. Indicate the type of service and direction of flow.

B. All valves shall be tagged except for valves located within 5 ft. of equipment it serves and in a direct line of sight. A schedule shall be submitted to Architect/Engineer indicating location, rooms served and function.

C. All equipment furnished shall be labeled.

**3.07 PIPING TEST**

A. Piping shall be tested with air at 75 psig or 1-1/2 times operation pressure, whichever is greater. System shall hold pressure for four hours, soap test joints.

**END OF SECTION**

**SECTION 223000**

**PLUMBING EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Water Heaters.

B. Domestic Water Recirculation Pumps.

C. Domestic Water Thermal Expansion Tanks.

D. Domestic Water Pressure Booster Systems.

F. Domestic Water Low Flow Pressure Tank.

### 1.02 RELATED DOCUMENTS

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

B. Section 220513 - Electric Motor Requirements For Plumbing Equipment.

C. Section 220553 - Identification For Plumbing Piping and Equipment.

D. Section 220716 - Plumbing Equipment Insulation.

E. Section 221005 - Plumbing Piping.

F. Section 221006 - Plumbing Piping Specialties.

### 1.03 REFERENCES

A. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2004 (with 2005 errata).

B. ANSI Z21.10.3 - Gas Water Heaters - Volume III - Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters; 2004.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

A. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

B. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation; operate within 25 percent of midpoint of published maximum efficiency curve.

**1.06 CERTIFICATIONS**

A. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1 or ANSI Z21.10.3, as applicable, in addition to requirements specified elsewhere.

B. Water Tanks: ASME labeled, to ASME (BPV VIII, 1).

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.07 DELIVERY, STORAGE, AND PROTECTION**

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

**1.08 WARRANTY**

A. Comply with Division 1 – Product Requirements.

**1.09 REGULATORY REQUIREMENTS**

A. Perform Work in accordance with State of Minnesota plumbing code.

B. Water heaters serving licensed commercial kitchen facilities shall be certified to NSF Standard 5 and shall be stamped with this certification.

**PART 2 PRODUCTS**

**2.01 GAS WATER HEATER – TANK TYPE, DIRECT VENT**

A. Direct vent, sealed combustion, tank type, water heater, 96% minimum thermal efficiency.

B. Gas input and storage capacity shall be as scheduled.

C. Unit shall include an electric ignition pilot with flame proving device and 100% gas shutoff.

D. Electronic control panel with digital display for temperature adjustment and fault diagnostics.

E. ASME temperature and pressure relief valve.

F. 3 year warranty for commercial application.

G. Combustion air and vent shall be concentric. Provide factory manufactured direct vent pipe, vent cap and accessories. Direct vent using Schedule 40 PVC as required by manufacturer.

H. Acceptable Manufacturers:
   1. State Ultra Force

**2.02 DOMESTIC HOT WATER RECIRCULATING PUMP**

A. Construction
   1. Body - bronze
   2. Impeller - bronze or polypropylene
   3. Shaft/Bearing - ceramic/carbon
   4. Maximum Operating Pressure - 150 psi
   5. Maximum Operating Temperature - 230 degrees F

B. Motor
   1. Type - open drip proof.
   2. Overload Protection - Built-in thermal.
   3. Characteristics - Non overload on pump curve.

C. Capacities - As scheduled on drawing.

D. Acceptable Manufacturers:
   1. Armstrong
   2. ITT Bell & Gossett
   3. Taco
   4. Thrush

**2.03 DOMESTIC HOT WATER THERMAL EXPANSION TANK**

A. Pressurized diaphragm type expansion tank designed to accept the increased volume of water created when the domestic storage tank is heated keeping the system pressure below the relief valve setting. Steel shell, polypropylene liner, butyl rubber diaphragm.

B. Acceptable Manufacturers:
   1. Amtrol Therm-X-Trol,
   2. Rheem Therm-X-Guard
   3. ITT Bell & Gossett

**2.04 DOMESTIC WATER PRESSURE BOOSTER SYSTEM**

A. Furnish and install one packaged pressure booster system. Variable speed pump control system shall be factory tested.

B. The system shall be capable of maintaining a constant system pressure automatically and

without regard to system flow demands. System pressure and capacity shall be as scheduled on the drawings.

C. Pumps shall be bronze fitted, end suction, centrifugal inline type. Suction and discharge headers shall be type L copper. Discharge of each pump shall be fitted with a check valve and isolation valve.

D. Motors shall be close-coupled selected so they do not operate over nameplate HP rating through sequence of pump rating capacity.

E. All three phase motors for mechanical equipment rated 1 horsepower and larger shall meet NEMA Premium Efficiency standards NEMA Standard MG1-2003.

F. The flow pressure sensor shall be field mounted and wired to pump logic controller.

G. The pump logic controller shall be microcomputer based in a NEMA 1 enclosure incorporating the following items:
1. Multi-fault memory and recall
2. On-screen help functions
3. LED pilot lights and switches
4. Soft-touch membrane keypad switches
5. Differential pressure in PSIG readout
6. Pressure in PSIG readout
7. Flow in GPM readout
8. Low suction pressure cut-out to protect the pumps against operating insufficient suction pressure
9. High system pressure cut-out to protect the piping system against pressure conditions
10. No flow shutdown to turn off pumps automatically

H. The system shall be skid mounted on a fabricated steel frame, completely factory assembled, hydraulically and electrically tested at the factory prior to shipment, and shipped to the installation as an integral unit ready to receive suction, discharge piping and incoming power. All control devices shall be preset to suit actual job conditions.

I. Acceptable Manufacturers:
1. Armstrong
2. Bell & Gossett
3. Or approved equal

**2.05 DOMESTIC WATER LOW FLOW PRESSURE TANK**

A. Low flow tank shall be ASME 125 psi working pressure complete with tank fitting, tank drain and charging valve, gauge glass and saddle supports.

C. Tank volume shall be a least 1 gallon for each GPM of domestic water booster pump capacity provided.

B. Acceptable Manufacturers:
1. Armstrong
2. Bell and Gossett
3. John Wood
4. Taco
5. Thrush

### 2.06 CONCRETE HOUSEKEEPING PAD

A. Concrete pads shall comply with requirements of Division 03.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:
   1. Support piping adjacent to pump such that no weight is carried on pump casings.
   2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

### 3.02 WATER HEATERS

A. Install water heaters on 4” concrete housekeeping pads or support shelves as required.

B. Make all piping connections.

C. Pipe relief valve to 12" above the floor.

D. Water heaters incorporating single wall heat exchangers must be permanently labeled to require that all components of the heat transfer medium be recognized as safe or be listed as approved for food contact by the United States Food and Drug Administration as listed in Code of Federal Regulations, title 21, part 182 of the Food Additive Regulations.

E. Water heaters shall be installed such that they are capable of being reached safely and quickly for inspection, repair, or replacement without requiring the use of tools or the removal of obstacles, panels, or similar obstructions.

### 3.03 DOMESTIC HOT WATER RECIRCULATING PUMPS

A. Install in line pumps with independent supports from piping.

B. Provide aquastat set to activate pump when system temperature is below setpoint (110°F). Unless noted otherwise, aquastat shall be installed at remote end of domestic hot water distribution system from recirculation pump.

### 3.04 DOMESTIC HOT WATER THERMAL EXPANSION TANKS

A. Install tank on cold water inlet to water heater. If check valve is installed on cold water inlet, install tank between check valve and water heater.

B. Tank connection shall be off of the bottom of the cold water inlet piping.

C. Provide tank support independent of piping.

### 3.05 DOMESTIC WATER PRESSURE BOOSTER SYSTEMS

A. Booster pump assembly shall be mounted on a raised concrete base. Install the vibration isolators furnished with the pump assembly.

B. Install piping flexible connectors on booster pump system with isolating gate valves on the building system side of the flexible connectors.

### 3.06 DOMESTIC WATER LOW FLOW PRESSURE TANKS

A. Mount tank at high point in distribution system. Provide shutoff valve with union or flanged connection to allow for servicing.

### 3.07 CONCRETE HOUSEKEEPING PADS

A. Provide 4” concrete housekeeping pads for all floor mounted equipment.

**END OF SECTION**

**SECTION 224000**

**PLUMBING FIXTURES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Sinks.

D. Electric Water Coolers.

E. Showers.

F. Bathtubs.

G. Service sinks.

H. Emergency Eye/Face Washes.

### 1.02 RELATED DOCUMENTS

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

B. Section 221005 - Plumbing Piping.

C. Section 223000 - Plumbing Equipment.

### 1.03 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.


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F. Shop drawings shall include all product literature for items listed.
   1. Fixtures
   2. Faucets
   3. Valves
   4. Traps
   5. Supplies

**1.04 REGULATORY REQUIREMENTS**

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.05 DELIVERY, STORAGE, AND PROTECTION**

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

**1.06 WARRANTY**

A. Comply with Division 1 - Product Requirements.

**PART 2 PRODUCTS**

**2.01 PLUMBING FIXTURE SCHEDULE**

A. Refer to the Plumbing Fixture Schedule on the plumbing drawings for specification information.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

**3.02 PREPARATION**

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

**3.03 INSTALLATION**

A. Refer to architectural drawings and details for exact locations of fixtures and equipment.

B. All fixtures and trim shall be of first grade quality and finish, free from flaws and scratches.

C. All fixtures shall have ground backs. Groups of fixtures shall be matched. All fixtures shall be white unless otherwise specified.


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D. Exposed flush valve, waste and supply pipe at the fixtures shall be chromium plated pipe with escutcheons.

E. Install components level and plumb.

F. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint sealants" for sealant and installation requirements. Omit sealant on counter set stainless steel sinks unless otherwise directed by manufacturer's installation instructions.

G. All fixtures shall be equipped with chrome angle 1/4 turn ball stops on water supplies. Public areas shall have loose key handles and chrome lever handles in private areas. Manufacturer: Brasscraft KT Series.

H. Provide 17 gauge adjustable "P" trap easily removable for servicing and cleaning for all fixtures above grade. Provide cast iron "P" trap on below grade installation. Option - Traps for lavs and sinks in concealed locations may be PVC if allowed by Code.

I. All lavatory and sink hot and cold water supply and waste lines not concealed within a cabinet shall be insulated with piping insulation covers. Comply with Specification Section 220719.

J. Flush levers on ADA-compliant flush tank water closets are allowed to be either on the left or the right side of tank and are not required to be on the wide side of the stall.

K. ADA designated water closets shall be installed with the top of the seat set between 17" and 19" above floor. Confirm exact mounting heights with architectural drawings.

**3.04 FIXTURE SUPPORTS**

A. Provide and all hangers, carriers, brackets, wall supports, bolts etc., required for proper installation.

B. Provide concealed hangers necessary to support all wall hung plumbing fixtures. Concealed hangers for lavatories, urinals and similar fixtures are to be provided with fastening devices to securely anchor hangers on walls or partitions.

C. Use additional bracing and brackets to support fixtures as may be furnished by the General Contractor. See Architectural drawings for details.

D. All anchor holes in the fixtures are to be utilized.

E. Carriers shall be Josam, Wade, Zurn or Smith.

**3.05 INTERFACE WITH WORK OF OTHER SECTIONS**

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B Coordinate with Division 26 for power to the sensor transformer and between the power module and the trim.

C. Refer to Architectural drawings for fixture mounting heights.


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**3.06 ADJUSTING**

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

**3.07 CLEANING AND PROTECTION**

A. Clean plumbing fixtures and equipment.

B. Do not permit use of fixtures during construction.

**3.08 FIXTURE ROUGH-IN**

A. When fixture rough-in is indicated on drawings, provide required waste water and vent piping in sufficient size to serve the proposed fixture. Cap all unconnected openings.

**3.09 MISCELLANEOUS CONNECTIONS**

A. Kitchen and Laundry Equipment Connections:
   1. The kitchen and laundry equipment is furnished by the supplier. This will include all sinks, faucets and sprays with strainers and tailpieces. Refer to architectural drawings for drawings and details.
   2. The Division 22 Contractor shall rough-in and make final connections for all hot and cold water, waste and vent. All floor drains shall be provided. The Division 22 Contractor shall further furnish p-traps, piping, valves and stops as required.
   3. Installation of the equipment will be provided by Division 11.

B. Emergency Shower and Eye Wash
   1. The water supply to emergency shower/eye wash stations shall be tepid and potable. Tepid mixed water shall be delivered through an approved mixing valve. See specification section 221006.
   2. The shower/eye wash stations shall be identified with a highly visible sign.
   3. Shower nozzle height shall be between 82 and 96 inches from floor, or as directed by administrative authority. Eye wash nozzles shall be 33 and 45 inches from floor and 6 inches from nearest obstruction or as directed by administrative authority.
   4. Installation shall comply with ANSI Z358.1.

**END OF SECTION**


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**SECTION 230513**

**ELECTRICAL MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

### 1.02 RELATED DOCUMENTS

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

B. Section 232300 – Refrigerant Piping and Split System Equipment

C. Section 233413 – HVAC Fans

D. Section 237313 – Modular Indoor Central-Station Air-Handling Units

### 1.03 REFERENCES

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2006.

B. NFPA 70 - National Electrical Code; National Fire Protection Association; 2008.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying premium efficiency and power factor for three phase motors larger than 1 horsepower.

D. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

### 1.05 QUALITY ASSURANCE

A. Conform to NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for the purpose specified and indicated.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.

**1.07 WARRANTY**

A. Comply with requirements of Division 1.

**PART 2 PRODUCTS**

**2.01 ELECTRIC MOTOR GENERAL CONSTRUCTION AND REQUIREMENTS**

A. Furnish electric motors as required for each motor driven unit. All motors must conform in every respect to the standard specifications of NEMA and bear nameplate of manufacturer, with current operating characteristics noted thereon. Motors shall be U.L. approved.

B. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

C. All electric motors shall be sized to meet the horsepower requirements of the driven unit at design characteristics including all V-belt and/or drive and coupling losses which are incurred without loading the motor beyond its nameplate horsepower rating. Where V-belt drives are employed, the motor horsepower nameplate ratings shall not be less than 115% of the driven unit brake horsepower requirements.

D. All motors shall be provided with ball roller bearings, and shall have provisions for lubrication unless specified otherwise. Motors shall be quiet when operating under full load operations. See schedules on the Mechanical/Electrical (ME) drawings for capacities.

E. Single phase motors shall be capacitor start, drip-proof. Three phase motors general purpose, squirrel cage induction type unless specified otherwise. Minimum service factors shall be 1.15. All motors single speed, 1750 rpm, unless specified otherwise for specific equipment.

F. Electric motor characteristics shall be as indicated on the drawings.

G. All three phase motors for mechanical equipment rated 1 horsepower and larger shall meet NEMA Premium Efficiency standards as shown on the following table. Motors shall be labeled to comply with NEMA Standard MG1-12.53 with the nominal efficiency printed on the nameplate. Efficiency to be based on a dynamometer test per IEEE, Standard 112, Method B.
   1. Minimum efficiency shall be provided per schedule.

**MOTOR SCHEDULE**

| | Open Drip-Proof (ODP) | | | Totally Enclosed Fan-Cooled (TEFC) | | |
|---|---|---|---|---|---|---|
| | **1200 RPM** | **1800 RPM** | **3600 RPM** | **1200 RPM** | **1800 RPM** | **3600 RPM** |
| **HP** | | | | | | |
| 1 | 82.5 | 85.5 | 77 | 82.5 | 85.5 | 77 |
| 1.5 | 86.5 | 86.5 | 84 | 87.5 | 86.5 | 84 |
| 2 | 87.5 | 86.5 | 85.5 | 88.5 | 86.5 | 85.5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | 88.5 | 89.5 | 85.5 | 89.5 | 89.5 | 86.5 |
| 5 | 89.5 | 89.5 | 86.5 | 89.5 | 89.5 | 88.5 |
| 7.5 | 90.2 | 91 | 88.5 | 91 | 91.7 | 89.5 |
| 10 | 91.7 | 91.7 | 89.5 | 91 | 91.7 | 90.2 |

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

### 3.02 WIRING

A. All 120V and low voltage control wiring for equipment provided by this Contractor shall be responsibility of this Contractor unless specified otherwise and clearly stated.

B. Electrical work shall comply with the requirements of the current applicable National Electrical Code and Division 26. Where this specification or the plans indicate requirements in excess of those of NEC, the compliance with NEC will not relieve the Contractor from furnishing and installing work as shown or specified.

C. All switching, protective devices and controls for equipment furnished under these Specifications shall be identified with black-white-black laminated 1/8" plastic plates. Plates shall be attached with self-tapping screws.

**END OF SECTION**

**SECTION 230519**

**METERS AND GAUGES FOR HVAC**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Thermometers and thermometer wells.

### 1.02 RELATED DOCUMENTS

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

B. Section 230913 – Instrumentation and Control Devices for HVAC

C. Section 233100 - HVAC Ducts and Casing

D. Section 234000 - HVAC Air Cleaning Devices

### 1.03 REFERENCES

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; The American Society of Mechanical Engineers; 1998 (Pub. 2000).

B. ASTM E 1 - Standard Specification for ASTM Thermometers; 2003a.

C. ASTM E 77 - Standard Test Method for Inspection and Verification of Thermometers; 1998 (Reapproved 2003).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Underwriters Laboratories, Inc.; 2005.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

### 1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

## PART 2 PRODUCTS

### 2.01 THERMOMETERS – AIR

A. Thermometer:

1. Case: Stainless steel, 5”, clear glass window.
2. Scale: Black on white.
3. Stem: Stainless steel, angle adjustable stem.

B. Acceptable Manufacturers:
1. Weiss
2. March
3. Trerice
4. U S Gauge
5. Weksler

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install thermometers in air duct systems on flanges.

C. Provide instruments with scale ranges selected according to service with largest appropriate scale.

D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

**3.02 SCHEDULE**

A. Thermometer – Air
1. Location:
a. Fresh air intakes
b. Air handling system – supply fan discharge
c. After each heating/cooling coil
l.

**END OF SECTION**

**SECTION 230529**

**HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Hangers and Supports.

### 1.02 RELATED DOCUMENTS

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

B. C. Section 231123 – Natural Gas Piping.

D. Section 232300 – Refrigerant Piping

### 1.03 REFERENCES

A. ASME B31.9 – Building Services Piping; The American Society of Mechanical Engineers; 2008.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide data on hangers and supports. Provide manufacturers catalog information.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURER:

A. Anvil

B. Felker

C. Hycon

D. Piping Tech.

E. Unistrut

F. B-Line

G. Superstrut

H. Michigan\Erico

### 2.02 PIPE HANGERS AND SUPPORTS

A. Conform to ASME B31.9.

B. All individual pipes shall be supported with adjustable clevis hangers of sizes as required to encompass insulated pipe. Provide sheet metal shields at all hanger points on insulated pipes.
   1. Anvil Fig. 260 or approved equal. (cast iron, steel and insulated copper pipe)
   2. Anvil Fig. CT-65 or approved equal. (uninsulated copper pipe)

B. All individual pipes shall be supported with adjustable ring hangers of sizes as required to encompass the insulated pipe. Provide sheet metal shields at all hanger points on insulated pipes.
   1. Anvil Fig. 97 or approved equal. (cast iron, steel and insulated copper pipe)
   2. Anvil Fig. CT-99 or approved equal. (uninsulated copper pipe)

C. "Trapeze" hangers and/or tunnel piping supports shall be Unistrut, Power Strut, or B-Line channel for pipe size 3" and smaller, for pipe 4" to 6" use 2" x 2" x 1/4" angle iron, for pipe size 8" to 12" use 3" x 3" x 3/8" angle iron using the appropriate diameter rod that will sufficiently support the total weight of all of the pipe and their contents being supported and the rod nutted on both sides of the hanger. Make provisions to pitch piping as required.

D. Hanger Rods etc.: Mild steel continuous threaded rod, heavy washers and heavy hex nuts.

**2.03 ATTACHMENTS TO STRUCTURE**

A. Concrete
   1. Poured - for loads between 400 lbs and 1140 lbs.
      a. Anvil Fig. 282.
   2. Poured - For loads up to 400 lbs.
      a. Anvil Fig. 285 or U channel type; B - Line B221 or Unistrut.
   3. Precast - Tapered wedge with locking sleeve: Quick Bolt.

B. Steel Beam Structure
   1. Beam Clamp
      a. For loads up to 1070 lbs - Anvil Fig 94 or approved equal.
      b. For loads up to 470 lbs - Anvil Fig 93 or approved equal.
   2. Welded beam attachment - Anvil Fig. 66.
   3. Steel washer and heavy nut for split joists.
   4. Angle or channel iron support spanning between beams and joists.

C. Wood
   1. Drill and use through bolts nutted on both sides of joist and malleable iron eye sockets.

**2.04 VERTICAL PIPE SUPPORTS**

A. All vertical piping shall be supported at each floor using riser clamps.
   1. Anvil Fig. 261. (cast iron, steel, and insulated copper pipe)
   2. Anvil Fig. CT 121. (uninsulated copper pipe)

**2.05 HANGER INSERTS**

A. Concrete inserts for loads between 400 and 1140 lbs.
   1. Anvil Fig. 282 or approved equal.

B. Concrete inserts for loads up to 400 lbs.
   1. Anvil Fig 285 or approved equal.

**2.06 SHEET METAL SHIELDS**

A. Sheet metal shields shall be Anvil Fig. 167 or galvanized sheet metal of equal gauge thickness.

**2.07 PIPE COVERING PROTECTION SADDLE**

A. For piping on pipe roller type support steel saddles.
   1. Anvil Fig. 160 through 165 or 165A and 166A as required.

**PART 3 EXECUTION**

**3.01 INSTALLATION - GENERAL REQUIREMENTS**

A. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

B. Provide all hangers and supports as required.

**3.02 PIPE HANGERS AND SUPPORTS**

A. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as scheduled.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Whenever copper piping comes directly in contact with steel support system, it shall be this Contractor's responsibility to wrap the pipe with two layers of 3M's #33 electrolytic tape. The length of tape shall be such to provide 2" overlap on each side of support.
   9. Insulated pipe support shall be supported with polysiocyanurate pipe insulation the same thickness as insulated pipe. Install between pipe and vapor barrier.
   10. Supports shall be sized for weights and pipe sizes encountered.
   11. Supports shall properly compensate for all thermal expansion and contraction.

B. Horizontal Hanger Spacing Schedule

   1. Steel Pipe

| Pipe or Tube Size | Hanger Spacing | Minimum Rod Diameter |
|---|---|---|
| 1/2" tube only | 5' | 1/4" |
| 1/2" - 1" | 7' | 3/8" |
| 1-1/4" - 1-1/2" | 9' | 3/8" |
| 2" | 10' | 1/2" |
| 2-1/2" | 11' | 1/2" |
| 3" | 12' | 1/2" |
| 4" | 14' | 5/8" |
| 5" | 16' | 5/8" |
| 6" and larger | 17' | 3/4" |

2. Copper Pipe

| Pipe or Tube Size | Hanger Spacing | Minimum Rod Diameter |
|---|---|---|
| 1/2" | 6' | 3/8" |
| 3/4" | 6' | 3/8" |
| 1" | 6' | 3/8" |
| 1-1/4" | 6' | 3/8" |
| 1-1/2" | 9' | 3/8" |
| 2" | 9' | 3/8" |
| 2-1/2" | 10' | 1/2" |
| 3" | 10' | 1/2" |
| 3-1/2" | 10' | 1/2" |
| 4" | 10' | 1/2" |
| 5" and larger | 10' | 5/8" |

**3.03 VERTICAL PIPE SUPPORTS**

A. Pipes with 25 feet of vertical height or more, without offsets shall be supported vertically as specified in Part 2 and/or detailed on the drawings.

B. Supports shall be sized for weights and pipe sizes encountered.

C. Supports shall properly compensate for all thermal expansion and contraction.

**3.04 BRACKETS, BRACES AND SUPPORTS**

A. Provide brackets, braces or reinforcing angles as may be required in all partitions, not sufficient in themselves to support fixtures or other wall mounted equipment included in this specification.

B. Pipe shall be supported from the building structure independently or from a separate support, no pipe line shall be supported from another pipe line or piece of equipment.

C. No equipment shall be supported by the piping system itself. All units shall be supported in a manner to allow service without removing large piping segments or valves. Provide structural members as required.

D. On thin masonry or hollow tile walls that are to be finished on opposite side of wall, use 3/8" brass through bolts extended entirely through wall with 3" cut washer on opposite side of wall. Bolt heads and washers shall be concealed under wall finish on opposite side of wall. On walls of accessible pipe spaces, use 3/8" brass through bolts and 3" cut washers exposed in pipe spaces.

E. On brick, masonry block, hollow tile or concrete walls not finished on opposite side of wall, use brass toggle bolts or 3/8" brass bolts extending at least 3" into wall secured in place lead inserts and caulked with silicone type caulk.

**END OF SECTION**

**SECTION 230548**

**VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Vibration isolators.

### 1.02 RELATED DOCUMENTS

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

B. Section 233414 - HVAC Fans

C. Section 237313 - Modular Indoor Central Station Air Handling Unit

### 1.03 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide schedule of vibration isolator type with location and load on each.

C. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

## PART 2 PRODUCTS

### 2.01 DUCTWORK

A. Flexible duct connection material shall be neoprene-coated glass fiber or fabric type, 6" wide with metal edging for fastening.

B. Acceptable Manufacturers:
1. Vent-Fan
2. United/McGill
3. Mercer Rubber Company
4. Titus
5. General Rubber
6. Industrial Acoustics
7. Elgen

### 2.02 EQUIPMENT

A. Vibration isolator shall be selected in accordance with the weight distribution so as to provide reasonably uniform deflection. Deflectors shall be 1" or as noted on drawings.

B. Equipment mounting type schedule based on Mason Industries Model Number.

1. Type D: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degrees arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30 degrees capability. Hangers shall be type 30N.
2. Acceptable Manufacturers:
   a. Vibration Mountings
   b. Vibration Eliminator
   c. Korfund Dynamics
   d. Industrial Acoustics

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Ductwork:
   1. Connections to be made with 1" x 1" x 1/8" angle on all rectangular openings and two #14 gauge 1" band on all round openings. Use 5/16" stove bolts or self-tapping screws located 6" o.c. for fastening flexible duct to ductwork.
   2. Flexible connectors shall be 6" wide and installed in a 4" space to allow for ample slack

C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

E. Provide pairs of horizontal limit springs on fans with more than 6.0 inches WC static pressure, and on hanger supported, horizontally mounted axial fans.

F. Support piping connections to equipment mounted on isolators using isolators or resilient hangers for scheduled distance.
   1. Select three hangers closest to vibration source for minimum 1.0 inch static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch static deflection or 1/2 static deflection of isolated equipment.

### 3.02 FIELD QUALITY CONTROL

A. Inspect isolated equipment after installation and submit report. Include static deflections.

**END OF SECTION**

**SECTION 230553**

**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe Labels.

### 1.02 REFERENCES

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 1996 (Reaffirmed 2002).

### 1.3 SUBMITTALS

A. Comply with requirements of Division 1.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Brady Corporation.

B. Champion America, Inc.

C. Seton Identification Products.

### 2.02 IDENTIFICATION – EQUIPMENT NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2 inch.
   3. Background Color: Black.

**2.03 TAGS**

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

**2.04 IDENTIFICATION – PIPE**

A. Color: Conform to ASME A13.1.

B. Plastic Tape Pipe Labels: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Pipe: Labels shall describe the contents and direction of flow. Labels shall be secured to pipe with full self-adhesive banding around pipe at each end of label. Labels shall be per the schedule in Part 3.

**2.05 IDENTIFICATION – VALVES**

A. Brass metal tags.

B. Control valves shall be tagged as to service and normal position.

C. Other valves tagged as to service and function.

D. Control valve tags shall have black background, other valves tags shall have colors corresponding to service described above.

E. Valve list shall be included into operation and maintenance manuals.

**2.06 IDENTIFICATION - EQUIPMENT**

A. Nameplates: Laminated three-layer plastic with engraved letters.

**PART 3 EXECUTION**

**3.01 PREPARATION**

A. Degrease and clean surfaces to receive adhesive for identification materials.

**3.02 INSTALLATION**

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install pipe labels in accordance with manufacturer's instructions.

D. Install tape pipe labels complete around circumference of pipe in accordance with manufacturer's instructions.

E. Identify air handling units, fans, etc., with plastic nameplates.

F. Label all ductwork at damper locations, describe damper type. Provide minimum .5 inch high black letters on yellow background.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags. Valve list shall be included in operation and Maintenance Manual.

I. Identify air terminal units and radiator valves with numbered tags.

J. Tag automatic controls, instruments, and relays. Key to control schematic.

K. Identify piping, concealed or exposed, with tape pipe labels. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

L. All gas piping, except exposed in mechanical rooms, shall be labeled every 5'-0".

**3.03 PIPE IDENTIFICATION SCHEDULE**

| | |
|---|---|
| CONDENSATE DRAIN | Y/B |
| REFRIGERANT LIQUID | Y/B |
| REFRIGERANT SUCTION | Y/B |
| | |

| |
|---|
| Y/B =YELLOW BACKGROUND/ BLACK LETTERS |
| G/W = GREEN BACKGROUND/ WHITE LETTERS |
| R/W = RED BACKGROUND/ WHITE LETTERS |
| B/W = BLUE BACKGROUND/ WHITE LETTERS |
| |

| Pipe Size | Band Width | Letter Height |
|---|---|---|
| 1/2" - 1-1/4" | 8" | 1/2" |
| 1-1/2" - 2" | 8" | 3/4" |
| 2-1/2" - 6" | 12" | 1-1/4" |
| 8" - 10" | 24" | 2-1/2" |
| 10" & UP | 32" | 3-1/2" |

**END OF SECTION**

**SECTION 230593**

**ADJUSTING AND BALANCING FOR HVAC**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

C. Sound measurement of equipment operating conditions.

D. Vibration measurement of equipment operating conditions.

### 1.02 RELATED DOCUMENTS

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

### 1.03 REFERENCES

A. AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Standard 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 1988.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC MN-1, AABC National Standards for Total System Balance.
   2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
   3. SMACNA HVAC Systems Testing, Adjusting, and Balancing.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to functional testing.

C. Support Commissioning Team activities by measuring air leakage, verifying system flow rates, or troubleshooting air distribution issues as needed or as requested by the Commissioning Authority.

D. Cooperate with Controls Technician the calibration of duct static pressure, building static pressure and airflow measurement.

E. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council, upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau:
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

F. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

## 3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage tests are complete, all corrections completed.
   12. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

## 3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

## 3.04 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

**3.05 RECORDING AND ADJUSTING**

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

E. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

**3.06 AIR SYSTEM PROCEDURE**

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. See Section 233413.

G. Vary branch air quantities by damper regulation.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

**3.07 SCOPE**

A. Test, adjust, and balance the following:
   1. Air Coils
   2. Terminal Heat Transfer Units
   3. Air Handling Units
   4. Fans
   5. Air Filters
   6. Air Terminal Units
   7. Air Inlets and Outlets

**3.08 MINIMUM DATA TO BE REPORTED**

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM
   4. Belt, size and quantity
   5. Motor sheave diameter and RPM
   6. Center to center distance, maximum, minimum, and actual

C. Cooling Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and actual
   6. Entering air DB temperature, design and actual
   7. Entering air WB temperature, design and actual
   8. Leaving air DB temperature, design and actual
   9. Leaving air WB temperature, design and actual
   10. Air pressure drop, design and actual

D. Heating Coils:
   1. Identification/number
   2. Location
   3. Service
   4. Manufacturer
   5. Air flow, design and actual

6. Leaving air temperature, design and actual
7. Air pressure drop, design and actual

E. Air Moving Equipment:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

F. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

G. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

H. Terminal Unit Data:
1. Manufacturer
2. Type, constant, variable, single
3. Identification/number
4. Size
5. Minimum static pressure
6. Minimum design air flow

7. Maximum design air flow
8. Maximum actual air flow
9. Inlet static pressure

I. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

J. Instrument Calibration Reports:
1. Instrument type and make
2. Serial number
3. Application
4. Dates of use
5. Dates of calibration

**END OF SECTION**

**SECTION 230713**

**DUCT INSULATION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Insulation jackets.

### 1.02 RELATED DOCUMENTS

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

B. Section 230553 - Identification for HVAC Piping and Equipment.

C. Section 233100 - HVAC Ducts and Casings

### 1.03 REFERENCES

A. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

B. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2002.

C. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2004.

D. ASTM C 1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2005.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.

F. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials; 2005.

G. ASTM E 2336 – Standard Test Method for Fire Resistive Grease Duct Enclosure System

H. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

I. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

J. UL 723 – Standard Method of Test of Surface Burning Characteristics of Building Materials; Underwriter’s Laboratories; 2003.

**1.04 SUBMITTALS**

A. Comply with requirements of Division 1.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

**1.05 DELIVERY, STORAGE, AND PROTECTION**

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

**1.06 ENVIRONMENTAL REQUIREMENTS**

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

**PART 2 PRODUCTS**

**2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION**

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. Acceptable manufacturer:
1. Owens-Corning
2. Johns Manville
3. Certain Teed
4. Knauf
5. Dow
6. Halsted

**2.02 TYPE 2 - EXTERNAL FIBERGLASS BLANKET DUCT INSULATION**

A. Ducts shall be insulated on the outside with 1-1/2" nominal thickness (1-1/8" installed thick) 1-1/2 lb. density flexible fiber blanket with an installed thermal conductance K = 0.24 Btu in./hr. sq. ft. or less at 75 degrees F and total insulated R value of 6.1 out of box.

B. Application
1. Insulation shall be cut slightly longer than circumference of duct to insure full thickness at corners and provide a 2" staple lap. All insulation shall be applied with edges tightly stapled seam sealed with 3" wide pressure sensitive aluminum foil tape.
2. The insulation shall be additionally secured to the bottom of all ducts 18" or wider by means of welded pins 12” on center and secured with speed clips. The protruding ends of the pins shall be cut off flush after the speed clips have been applied.

C. Vapor barrier
   1. Insulation shall be furnished with a factory applied foil-scrim-kraft facing consisting of an aluminum foil (minimum .7 mil thick) reinforced with fiber glass yarn mesh and laminated to 40 lb. chemically treated, fire resistant kraft. Where painting of insulation is required, provide a white all service jacket.
   2. The vapor-barrier facing shall be thoroughly sealed with a tape where the pins have pierced through by applying a vapor adhesive to both surfaces as recommended by the manufacturer.
   3. All joints and penetrations of the vapor barrier shall be sealed with 3" pressure sensitive aluminum foil tape. All cuts or tears shall be sealed with strips of the aluminum foil tape.

**2.03 TYPE 4 - EXTERNAL FIBERGLASS BOARD DUCT INSULATION**

A. Ducts shall be insulated on the outside with 2" thick 3 lb. density semi-rigid glass fiberboard with a thermal conductance K = 0.23 Btu in./hour sq. ft. degrees F or less at 75 degrees F and total insulated R value of 8.7 out of box.

B. Application
   1. Impaling Over Pins: All insulation shall be applied with edges tightly butted. Insulation shall be impaled on pins welded to the duct 12" on center and secured with speed clips. The protruding ends of the pins shall be clipped off flush with the surface of the insulation.

C. Vapor Barrier
   1. Insulation shall be furnished with a factory applied foil-scrim-kraft facing consisting of an aluminum foil (minimum .7 mil thick) reinforced with fiber glass yarn mesh and laminated to 40 lb. chemically treated, fire resistant kraft where a vapor barrier is required. Where painting of insulation is required, provide a white all service jacket, in lieu of aluminum foil.
   2. All joints and penetrations of the vapor barrier shall be sealed with 3" wide aluminum foil pressure sensitive tape. All cuts or tears shall be sealed with strips of the aluminum foil tape.

**2.04 TYPE 7 - INTERNAL FIBERGLASS DUCT LINER BOARD (SOUND INSULATION)**

A. All ducts where indicated herein shall be sound insulated with 1" thick, 1-1/2 lb. density semi-rigid duct liner. The NRC value shall not be less than 0.75 according to ASTM Test Method C-423. Thermal conductance shall be K = 0.23 Btu in./hour sq. ft. degrees F or less at 75 degrees F and total insulated R value of 4.3. Liner shall not support mold or fungus growth and shall be tested per ASTM C-665.

B. Application
   1. Velocities to 1,500 feet per minute.
      a. The duct liner shall be applied with 100% coverage of approved fire resistant adhesive. On ducts over 20" wide or deep the liner shall be additionally secured with mechanical fasteners welded to the duct on maximum 15" centers. Fasteners shall start within 2" of the leading edge of each section and within 3" of the leading edge of all cross joints within the duct section. All exposed edges and the leading edge of all cross joints of the liner shall be heavily coated with an approved fire-resistant adhesive.
      b. The duct liner shall be cut to assure snug closing corner joints, the coated mat surface of the liner shall face the air stream, transverse joints shall be neatly butted,

and any damaged areas shall be heavily coated with an approved fire resistant adhesive.

2. Velocities from 1,500 to 4,000 feet per minute.
   a. The duct liner shall be applied with 100% coverage of approved fire resistant adhesive. On horizontal runs, tops of ducts over 12" in width and/or sides over 16" in height shall be additionally secured with mechanical fasteners welded to the duct on a maximum of 15" centers. On vertical runs mechanical fasteners shall be spaced on maximum of 15" centers on all width dimensions over 12". Fasteners shall start within 2" of the leading edge of each section and within 3" of the leading edge of all cross joints within the duct section.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

### 3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

F. Duct Liner (Sound Insulation)
   1. Velocities to 1,500 feet per minute.
      a. The duct liner shall be applied with 100% coverage of approved fire resistant adhesive. On ducts over 20" wide or deep the liner shall be additionally secured with mechanical fasteners welded to the duct on maximum 15" centers. Fasteners shall start within 2" of the leading edge of each section and within 3" of the leading

edge of all cross joints within the duct section. All exposed edges and the leading edge of all cross joints of the liner shall be heavily coated with an approved fire-resistant adhesive.

b. The duct liner shall be cut to assure snug closing corner joints, the coated mat surface of the liner shall face the air stream, transverse joints shall be neatly butted, and any damaged areas shall be heavily coated with an approved fire resistant adhesive.

**3.03 DUCT INSULATION SCHEDULE**

A. This contractor shall inspect that all ductwork has been properly sealed prior to installing insulation.

B. Extend ductwork insulation without interruption through walls, floor and similar ductwork penetrations, except where otherwise indicated.

C. Supply Air Ductwork
1. Supply ductwork shall be insulated with Type 2 as described in Part 2 - Products.

D. Return Air Ductwork
1. All return ductwork within 10 fan diameters either side of a fan shall be insulated with Type 2 as described in Part 2 - Products.
2. All return ductwork within unconditioned spaces shall be insulated with Type 2 as described in Part 2 - Products.

E. Internally Lined Ductwork (Supply, Return, and Transfer Duct)
1. All ducts as indicated below shall be lined with Type 7 insulation as described in Part 2 - Products.
   a. Supply ductwork - where indicated on the drawing.
   b. Return ductwork - where indicated on the drawing.
   c. Transfer ductwork - all ducts.
2. Duct sizes listed on the drawings are internal sizes. Where insulation is applied to the inside of the ducts, the metal size of the duct shall be increased in amount to result in internal dimensions equal to that shown on the drawings.
3. Where sound insulation is specified and/or shown for ducts which also require thermal insulation in this specification, the exterior thermal insulation thickness may be reduced or deleted such that the R value of the combined internal and the external insulation is not less than the R value of the thermal insulation specified.

F. Exhaust Ductwork
1. All exhaust ductwork shall be insulated a minimum of 10'-0", measured both from the exhaust fan inlet and/or outlet, with external board Type 4 insulation as described in Part 2 - Products.

G. Outdoor Air Ductwork
1. All ducts shall be insulated with Type 4 insulation as described in Part 2 - Products.

**END OF SECTION**

**SECTION 230719**

**HVAC PIPING INSULATION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Piping insulation.

### 1.02 RELATED DOCUMENTS

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

B. Section 232300 – Refrigerant Piping.

### 1.03 REFERENCES

A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2004.

B. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2000.

C. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2004.

D. ASTM C 533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2007.

E. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2005.

F. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation; 2006.

G. ASTM C 585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 1990 (Reapproved 2004).

H. ASTM C 591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2005.

I. ASTM C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2003.

J. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.

K. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2007.

L. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

M. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

**1.04 SUBMITTALS**

A. Comply with requirements of Division 1.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

**1.05 DELIVERY, STORAGE, AND PROTECTION**

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

**1.06 ENVIRONMENTAL REQUIREMENTS**

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

**PART 2 PRODUCTS**

**2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION**

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

B. Acceptable Manufacturers:
1. Knauf Insulation.
2. Johns Manville Corporation.
3. Owens Corning Corp.
4. CertainTeed Corporation.

**2.02 TYPE 4 - FOAM PLASTIC TUBULAR AND SHEET INSULATION**

A. Flexible elastomeric material with 3/4" thickness designed for varied services at temperatures between -40 degrees F and 220 degrees F.

B. Fittings for piping shall be insulated with mitered segments which match the material used. All butt joints shall be joined by sealing with a waterproof vapor barrier adhesive as recommended by the insulation manufacturer.

C. When applying sheet insulation to metal surfaces, brush on a coat of adhesive to the clean, dry metal, covering an area to the size of one sheet. Apply a brushcoat of adhesive to the back of the sheet, except for 1/2" wide border around the edges. After adhesive is on the metal surface and the sheet has dried to a nonsticky state, position sheet so that the edges

overlap the previously installed sheets by 1/8". Apply light pressure to adhere a spot in the center of the sheet only and compress butt edges into place. Bond sheet by pressing firmly into place. Spread joints and coat with adhesive. DO NOT FILL JOINT WITH ADHESIVE.

D. For outdoor application, apply two coats of finish as recommended by the insulation manufacturer.

E. Acceptable manufacturers:
   1. AP / Aramaflex 25/50 – Armacell International

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

**3.02 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

G. Insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:
   1. Application: On all piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert configuration: Shall be the same thickness and contour as adjoining insulation, for pipes up thru and including 6” the length shall be 12” long, for piping 8” and larger it shall be 15” long.
   5. Insert material: Insulation material as described in Part 2.03 Products suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

**3.03 HVAC PIPING INSULATION SCHEDULE**

A. Condensate Drain Piping
1. All runouts from cooling coil drain pans located above a suspended ceiling shall be insulated with 1/2" thick elastomeric material described by Type 4 in Part 2 Products.

B. Refrigeration Piping
1. Suction line shall be insulated with elastomeric type as described by Type 4 in Part 2 – Products.
2. Insulation thickness shall conform to tables in this section.

**BASED ON ASHRAE STANDARD 90.1-2004:**

C. Table 1

Table 1 - Minimum Insulation Thickness for Pipe Sizes* (In.)

| Piping System | | Temp. Degrees F | & less | 1" & less | 1" to 1-1/4" | | 1-1/2" to 3" | 4" & 6" | 8" Up |
|---|---|---|---|---|---|---|---|---|---|
| Pumped condensate | any | 1-1/2 | 1-1/2 | | 2 | 2 | 2 | | |
| | | | | COOLING SYSTEMS | | | | | |
| Chilled Water | | 40-60 | | 1/2 | 1 | | 1 | 1 | 1 |
| Refrigerant or brine | | 39 or less | | 1/2 | 1 | | 1 | 1 | 1 |

* Piping exposed to outdoor air, increase thickness by 1/2"

**END OF SECTION**

**SECTION 230913**

**INSTRUMENTATION AND CONTROL DEVICES FOR HVAC**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Temperature sensors.

B. Differential pressure sensors.

C. Damper operators.

D. Freezestat

### 1.02 RELATED DOCUMENTS

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

C. Section 220519 - Meters and Gages for Plumbing Piping

D. Section 230519 - Meters and Gages for HVAC Piping

E. Section 233300 - Air Duct Accessories: Control dampers and combination fire-smoke dampers.

F. Section 230993 - Sequence of Operations for HVAC Controls.

### 1.03 REFERENCES

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide description and engineering data for each control system component. Indicate sensor data including range, accuracy, and drift.

C. Shop Drawings: Provide installation and wiring diagrams, and written description of operation. Submit schedule of valves indicating size, flow, and pressure drop for each valve.

D. Manufacturer's Installation Instructions: Provide for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors.
   1. Revise shop drawings to reflect actual instrumentation installed.

F. Maintenance Data: Include recommended frequency of inspection and cleaning; cleaning method and cleaning materials; and frequency of re-calibration.

G. Warranty: Submit manufacturer’s warranty, forms filled out in Owner’s name, and copies sent to the manufacturer.

**1.05 QUALITY ASSURANCE**

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

**1.06 WARRANTY**

A. Comply with requirements of Division 1.

**PART 2 PRODUCTS**

**2.01 TEMPERATURE SENSORS – WALL MOUNTED – PUBLIC SPACES**

A. Wall mounted temperature sensors for lobbies and public spaces shall meet the following requirements
   1. White protective enclosure. There shall be no manufacturer's logo, name, or thermometer on the exposed wall plate.
   2. Wall plate shall be primed for final coat in accordance with Architect.
   3. 100 or 1,000 Ohm platinum RTD with a minimum temperature coefficient of resistance 0.00385 Ohm/Ohm/ºC.
   4. Accuracy of 1ºF.
   5. Range 32°F to 100°F.

B. Acceptable Manufacturer:
   1. Coordinate with the Owner.

**2.02 FREEZESTAT**

A. Low limit thermostat (freezestats) shall meet the following requirements
   1. Minimum 6 feet to maximum 20 feet of vapor tension element, to be serpentined across the coil face. Wire multiple sensors in series to provide minimum of one linear foot of sensor for every square foot of coil face area. Provide supports at bends and intermediate points as needed to prevent sagging or movement within the air stream.
   2. Wire thermostats to trip a latching relay that will shut AHU fan down when HOA switch is in Hand or Auto position.
   3. Manual reset.
   4. Setpoint with scale adjustable manually from 32°F to 45°F
   5. Rated for 16 Amp at 120 Volt.
   6. Range 32°F to 100°F.

B. Acceptable Manufacturer:
   1. Coordinate with the Owner.

**2.03 DIFFERENTIAL PRESSURE SWITCH – AIR – FAN SHUTDOWN**

A. Differential pressure switch shall meet the following requirements
   1. UL approved.
   2. Adjustable set point with range appropriate to application.
   3. 1/4 inch compression fittings suitable for copper sensing tube.
   4. Operating temperature range of 0°F to 160°F
   5. Manual reset

B. Acceptable Manufacturer:

1. Coordinate with the Owner.

**2.04 CONTROL DAMPERS**

A. Smoke dampers and CF/S dampers are specified under Section 233300.

B. Control dampers are specified under Section 233300.

C. Control Damper Actuators - Electric
   1. Provide spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Beginning of installation means installer accepts conditions as specified.

B. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

**3.02 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with drawings and room details before installation.

C. Mount freeze protection thermostats using flanges and element holders.

D. Provide lockable guards on thermostats in entrances, public areas, and where indicated.

E. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

F. All power and low voltage wiring and shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals.

G. The Contractor shall be responsible for all electrical installation required for a fully functional system. All wiring shall be in accordance to all local and national codes plus Division 26. All 120V voltage wiring, all low voltage wiring not in ceiling plenums and all low voltage wiring in equipment rooms shall be installed in conduit in accordance with Division 26. All electronic wiring shall be #18 AWG minimum and shielded, if required.

H. Ceiling Access Panels
   1. The Contractor shall coordinate with Section 003113 for ceiling access to all devices.

**END OF SECTION**

**SECTION 230993**

**SEQUENCE OF OPERATIONS FOR HVAC CONTROLS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Sequence of operation for:
   1. PTAC units.
   2. Air Handling Units (AHU).
   3. Exhaust Fans (EF).

### 1.02 RELATED DOCUMENTS

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

B. Section 230913 - Instrumentation and Control Devices for HVAC.

### 1.03 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
   1. State each sequence in small segments and give each segment a unique number for referencing in Functional Test procedures.
   2. Include at least the following sequences:
      a. Start-up.
      b. Warm-up mode.
      c. Normal operating mode.
      d. Unoccupied mode.
      e. Shutdown.
      f. Capacity control sequences and equipment staging.
      g. Temperature and pressure control, such as setbacks, setups, resets, etc.
      h. Detailed sequences for all control strategies, such as economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
      i. Effects of power or equipment failure with all standby component functions.
      j. Sequences for all alarms and emergency shut downs.
      k. Seasonal operational differences and recommendations.
      l. Interactions and interlocks with other systems.
   3. Include initial and recommended values for all adjustable settings, setpoints and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
   4. For packaged controlled equipment, include manufacturer's furnished sequence of operation amplified as required to describe the relationship between the packaged

controls and the control system, indicating which points are adjustable control points and which points are only monitored.
5. Include operating schedules.

C. Hand-Off-Auto function: HOA switch may be provided by the equipment manufacturer, by Division 26, or as part of a speed control unit (VFD).
1. When furnished integral with equipment, manufacturer shall determine HOA functionality.
2. When HOA function is provided with the VFD, or is furnished and installed by Division 26:
a. In Hand position, system shall be under manual control.
b. In Off position, system shall be in the Safety default position.
c. In Auto position, system shall be under the control of the BMCS.

D. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
1. Label with settings, adjustable range of control and limits.
2. Include flow diagrams for each control system, graphically depicting control logic.
3. Include the system and component layout of all equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
4. Include preliminary graphic displays indicating mechanical system components, control system components, and controlled function status and value.
5. Include a key to abbreviations.

E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

F. Occupied hours shall be determined by the Owner.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PTAC UNITS (ALL)**

A. Units shall heat or cool and ventilate their spaces, 24 hours per day, 7 days per week. Units shall deliver 50 CFM of tempered outside, regardless of the space temperature setpoint on the Thermostat.

B. Units shall be controlled by an a remote Thermostat. The Thermostat shall be adjustable by the room occupant. The units shall have an alarm sent to the Owner, upon room space temperatures below 50 degrees F. and 90 degrees F. (adj.).

**3.02 AHU (AHU-1 through 8)**

A. Units shall be constant volume and shall heat or cool and ventilate their spaces, during occupied hours. Each AHU shall be connected to its associated Condensing Unit.

B. Units shall discharge 55 degrees F. (adj.) during occupied hours. A Freezestat shall send an alarm shall to the Owner, upon the discharge space temperatures below 50 degrees F. and above 70 degrees F. (adj.).

C. Each zone associated with its AHU, shall have an electric Reheat Coil, with a Remote Thermostat. Space temperature setpoints shall be determined by the Owner. Night setback

temperatures for energy savings, shall be determined by the Owner.

### 3.05 EF (EF-1 through 12)

A. The units shall operate 24 hours per day, 7 days per week.

**END OF SECTION**

**SECTION 232300**

**REFRIGERANT PIPING AND SPLIT SYSTEM EQUIPMENT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Condensing units.

D. Valves.

E. Evaporator units.

F. Check valves.

### 1.02 RELATED DOCUMENTS

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

### 1.03 REFERENCES

A. ARI 710 - Performance Rating of Liquid-Line Dryers; Air-Conditioning and Refrigeration Institute; 2004.

B. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Driers; Air-Conditioning and Refrigeration Institute; 2005.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2001.

E. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).

F. ASTM B 280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2003.

G. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.

**1.04 SYSTEM DESCRIPTION**

A. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gauge taps at compressor inlet and outlet.
   3. Use check valves on compressor discharge.

**1.05 SUBMITTALS**

A. Comply with requirements of Division 1.

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Test Reports: Indicate results of leak test, acid test.

E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

F. Submit welder's certification of compliance with ASME (BPV IX).

**1.06 REGULATORY REQUIREMENTS**

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

C. Welders Certification: In accordance with ASME (BPV IX).

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

**1.07 DELIVERY, STORAGE, AND HANDLING**

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

**PART 2 PRODUCTS**

**2.01 PIPING**

A. Copper Tube: ASTM B 280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

**2.02 SPLIT SYSTEMS**

A. Provide where shown on Drawings packaged compressor-condensing and ductless wall mounted evaporator units. Units shall be shipped prewired ready for refrigerant and electrical connections. Unit shall have a cooling capacity of, as shown on the Drawings, gross refrigeration effect at 95 degrees ambient temperature and 45 degrees saturation suction temperature. Unit shall be complete with casing, compressors, condenser, fans, motors and low ambient controls. Units shall utilize R410A refrigerant. Provide condensate pumps for proper lift and disposal to safewaste unit discharge.

B. Evaporator unit fan shall be 3 speed. Provide wall mounted controls for each unit. Provide refrigeration line sets for each unit, sized and charged for the application based on manufacturer's recommendations.

C. Acceptable Manufacturers:
   1. Sanyo
   2. Mitsubishi
   3. Carrier

**PART 3 EXECUTION**

**3.01 PREPARATION**

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

**3.02 INSTALLATION**

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

G. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 083100.

H. Flood piping system with nitrogen when brazing.

I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

J. Insulate piping and equipment; refer to Section 230716 and Section 230719.

K. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

L. Fully charge completed system with refrigerant after testing.

M. Provide 4" concrete pad or mounting frame for locating compressor/condenser units. Set units in place, level and secure to pad.

**3.03 REFRIGERANT PIPING TESTS**

A. Leak tests shall be made before installed on piping. Tests shall be conducted using nitrogen, at 250 psi on the high side, and 160 psi on the low side of the system.

B. After completion of the above tests, apply a 28" (Hg) vacuum to the entire system; no more than a 5" change will be accepted after 24 hours.

**3.04 DEMONSTRATION AND TRAINING**

A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.

**END OF SECTION**

**SECTION 233100**

**HVAC DUCTS AND CASINGS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Metal ductwork.

B. Flexible ductwork..

C. Air Distribution duct leakage test.

### 1.02 RELATED DOCUMENTS

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

B. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

C. Section 230713 - Duct Insulation:

D. Section 233300 - Air Duct Accessories.

E. Section 233700 - Air Outlets and Inlets.

### 1.03 REFERENCES

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2004a.

B. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.

C. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 1985, First Edition.

D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

### 1.04 PERFORMANCE REQUIREMENTS

A. Provide all labor and materials to install complete and operational duct systems.

B. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

C. Make connections to equipment, louvers, diffusers, devices, etc. shown on the drawings.

D. Installed under this section but not furnished:
   1. Motorized control dampers
   2. Smoke damper/fire smoke dampers

**1.05 SUBMITTALS**

A. Comply with requirements of Division 1.

B. Product Data: Provide data for duct materials.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

E. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

F. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements.

G. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

**1.06 REGULATORY REQUIREMENTS**

A. Construct ductwork to NFPA 90A standards.

**1.07 ENVIRONMENTAL REQUIREMENTS**

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

**PART 2 PRODUCTS**

**2.01 DUCTWORK - LOW AND MEDIUM PRESSURE – RECTANGULAR**

A. Ventilating ductwork shall be galvanized sheet steel except where specified otherwise, ASTM Specification A-93-59T in gauges as follows, with all sheets over 17" in width being crossbroken.

| REQUIRED GAUGES (RECTANGULAR DUCTS) | | | |
|---|---|---|---|
| Low Pressure (Duct Pressure to 1-1/2" S.P. | | | Medium Pressure (Duct Pressure 1-5/8" to 5-1/2") |
| Sizes Inches-Width | Iron U.S. Gauge | Aluminum B&S Gauge | Iron U.S. Gauge |
| 4 thru 12 | #26 | #24 (.02) | #24 |
| 13 thru 30 | #24 | #22 (.025) | #22 |
| 31 thru 54 | #22 | #20 (.032) | #20 |
| 55 thru 84 | #20 | #18 (.040) | #18 |
| 85 thru 96 | #18 | #15 (.051) | #16 |

B. Ductwork that will be painted shall be made using “paint grip” galvanized steel. Oils shall not be used in the manufacturing process.

**2.02 SHEET METAL WORK - CIRCULAR DUCT**

A. All ductwork will be manufactured by the same firm to assure tight fit of all ductwork and components whether circular or rectangular.

B. Ductwork to be painted shall be made with “paint grip” galvanized steel. The forming process shall use a lubricant compatible with the paint to be applied.

C. Round duct shall be manufactured of galvanized steel meeting ASTM-A653 and A924.by the following methods and in the minimum gauges listed.

| Diameter | Minimum Gauge | Method of Manufacture |
|---|---|---|
| 3" thru 14" | 26 Ga. | Spiral Lockseam |
| 15" thru 26" | 24 Ga. | Spiral Lockseam |
| 27" thru 36" | 22 Ga. | Spiral Lockseam |
| 37" thru 50" | 20 Ga. | Spiral Lockseam |

D. Fittings and couplings shall be of the following minimum gauges:

| Diameter | Gauge |
|---|---|
| 3" thru 36" | 20 Gauge |
| 38" thru 50" | 18 Gauge |

E. All fittings are to have continuous welds along all seams. All divided flow fittings are to be manufactured as separate fittings, not as tap collars welded into spiral duct sections.

F. All 90 degree tees and 45 degree laterals (wyes) up to and including 12" diameter tap size shall have a radiused entrance into the tap, produced by machine or press forming. The entrance shall be free of weld build-up, burrs or irregularities.

G. Elbows in diameters 3" through 14" shall be two section stamped elbows. All other elbows shall be gored construction with all seams continuous-welded. Elbows shall be fabricated to a centerline radius of 1.5 times the cross-section diameter. All elbows, not die-stamped, shall be fabricated according to the following schedule:

| Elbow Angle | Number of Gores |
|---|---|
| Less than 35 degrees | 2 |
| 36 degrees over 71 degrees | 3 |
| Over 71 degrees | 5 |

H. Where it is necessary to use 2-piece mitered elbows, they shall have turning vanes in accordance with the following schedule:

| Diameter | Number of Vanes |
|---|---|
| 3" thru 9" | 2 |
| 10" thru 14" | 3 |
| 15" thru 19" | 4 |
| 20" thru 60" | 5 |

I. The leading edge of all vanes in ducts over 20" diameter shall be hemmed with 1/2" fold-back. Turning vanes in ducts over 24" shall be reinforced by rods or sectional construction to limit unsupported length of 24". Vanes shall be minimum of 20 gauge.

**2.03 COUPLINGS FOR ROUND DUCT**

A. Pipe-to-pipe joints in diameters to 50" are by the use of sleeve couplings, reinforced by rolled beads.

B. Pipe-to-fitting joints in diameters to 50" are by slip-fit of projecting collar of the fitting into the pipe.

C. Insertion length of sleeve coupling and fitting collar is 2" for diameters through 9" and 4" for diameters 10" and up.

**2.04 FLEXIBLE DUCTWORK - LOW PRESSURE**

A. Flexible duct for connections, where shown to diffusers, to registers, or air bonnets shall be made with factory pre-insulated duct composed of a corrosion-resistant reinforcing wire helix permanently bonded and enclosed in Tedlar film, then covered with 1" thick 3/4 lb. density fiberglass insulation blanket sheathed in a vapor barrier laminated to glass mesh.

B. Ductwork must comply with latest NFPA Bulletin 90A and be tested as Class 1 Air duct material, UL Standard 181.

C. Engineering data shall be as follows:

| | | |
|---|---|---|
| 1. | C factor: | 0.23 Btu/hr./sq. ft./degrees F at 75 degrees F |
| 2. | Vapor Barrier Permeance: | 0.30 GR/24 hr./M sq./MN hq<br>per ASTM Method E96, Procedure A |
| 3. | Temperature Range: | 0 degrees F to 180 degrees F |
| 4. | UL Rated Velocity: | 4000 cfm |
| 5. | Flame Spread: | not over 25 |
| 6. | Smoke Developed: | not over 50. |

D. Acceptable manufacturers:
1. Owens-Corning Fiberglass
2. Glass Flex type OC-41
3. Thermaflex type M-KE
4. Metalfax
5. Wiremold.

**2.05 DUCTWORK FABRICATION**

A. All ductwork shall have all longitudinal and transverse joints butted and sealed with 3M's or United Sheet Metal's mastic duct sealer products.

B. Crossbreaking. All rectangular ducts whose width is 18" or greater shall have sheet metal surfaces crossbroken. Crossbreaking is not required if the ducts are insulated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence

downstream.

E. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

F. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

G. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

H. Duct Area. Where sound insulation is specified and/or shown for ducts, they shall be constructed so the sizes shown on the drawings are the dimensions inside the insulation.

I. A reduction in duct area because of the installation of sound insulation will not be permitted.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. All ductwork shall conform accurately to the dimensions indicated on the drawings. All ducts shall be straight and smooth on the inside with neatly finished joints. Ductwork shall be installed in accordance with the recommendations of the latest edition of ASHRAE Guide and Data Book (Systems and Equipment) Air Duct Design. Gauge of metal and reinforcing shall be in accordance with their table.

B. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

C. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

D. Changes of Duct Locations. Ducts shall be installed substantially as indicated on the drawings. However, where conflicts occur with other trades, the Architect reserves the right to require the Contractor to make minor changes in duct locations without extra cost to the Owner.

E. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

F. Duct take-off fittings. All take-offs from main trunk ducts shall be of the "divertor" type unless specifically shown otherwise

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

I. Use double nuts and lock washers on threaded rod supports.

J. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

### 3.02 DUCT HANGERS AND SUPPORTS

A. Ductwork shall be substantially supported with hangers to structure depending upon local conditions, placing supports according to recommendations of SMACNA along entire length of duct. Upper ends of hangers to be securely fastened to structure or masonry by means of expansion bolts. No wood plug driven in masonry will be permitted. Punching of holes in any way will not be allowed. No nails, wires or cotter pins shall be run through ducts. All necessary hangers, braces, tees, angles and supports will be provided and secured in a satisfactory manner.

B. Horizontal. All ductwork shall be securely anchored to the building construction in a manner to be free from vibration and swaying under all conditions of operation. Ducts 60" x 24" and larger shall be supported with trapeze hangers consisting of rods and angles. Hangers for ducts smaller than 60" x 24" shall be attached to the duct with a minimum of two (2) screws and shall have straps of the same material as the duct in accordance with the following table where; W = Width and D = Depth of the duct.

Galvanized and Stainless Steel
Rectangular Duct Hangers
Minimum Size

| | 10 ft Spacing | | 8 ft Spacing | |
|---|---|---|---|---|
| W + D | STRAP | ROD | STRAP | ROD |
| 96" or Less | 1" x 16 GA | 3/8" | 1" x 18 GA | 3/8" |
| 97" - 120" | 1" x 16 GA | 1/2" | 1" x 16 GA | 3/8" |
| 168" | 1" x 16 GA | 1/2" | 1" x 16 GA | 1/2" |
| 192" | - - - - - - - - | 1/2" | 1" x 16 GA | 1/2" |

| | |
|---|---|
| 193" & Up | SPECIAL ANALYSIS REQUIRED |

Aluminum
Rectangular Duct Hangers
Minimum Size

| | 8 ft Spacing | | | |
|---|---|---|---|---|
| W + D | STRAP | ROD | | |
| 72" or Less | 1" x 14 GA | 3/8" | | |
| 71" - 98" | 1" x 12 GA | 3/8" | | |
| 99" - 120" | 1" x 11 GA | 1/2" | | |
| 121" - 192" | 1" x 11 GA | 1/2" | | |

| | |
|---|---|
| 193" & Up | SPECIAL ANALYSIS REQUIRED |

Galvanized and Stainless Steel
Round Duct Hangers
Minimum Size

| DUCT DIAMETER | MAXIMUM SPACING | STRAP | ROD | QTY. |
|---|---|---|---|---|
| 10" - 24" | 12' | 1" x 20 GA | 1/4" | 1 |
| 25" - 36" | 12' | 1" x 18 GA | 3/8" | 1 |

| | | | | |
|---|---|---|---|---|
| 37" - 60" | 12' | 1" x 16 GA | 3/8" | 2 |
| 61" - 84" | 12' | 1" x 16 GA | 3/8" | 2 |

Aluminum
Round Duct Hangers
Minimum Size

| DUCT DIAMETER | MAXIMUM SPACING | STRAP | ROD | QTY. |
|---|---|---|---|---|
| 3" - 26" | 12' | 1" x 14 GA | 3/8" | 1 |
| 27" - 50" | 12' | 1" x 14 GA | 3/8" | 1 |
| 51" - 60" | 12' | 1" x 12 GA | 3/8" | 2 |
| 61" - 84" | 12' | 1" x 11 GA | 3/8" | 2 |

C. Vertical. Where duct risers pass through floors, supporting angles shall be securely fastened to ducts with rivets or screws attached to the ducts with the angles supported on adjoining floor construction in an approved manner. Vertical ductwork shall be supported at each floor. Angles shall be of the same material as the adjacent duct.

| Duct Size | Angle Dimensions |
|---|---|
| 36" x 18" | 1-1/2" x 1-1/2" x 1/8" |
| 48" x 24" | 2" x 2" x 1/8" |
| 60" x 30" | 2" x 2" x 3/16" |
| 60" x 60" | 2" x 2" x 1/4" |

**3.03 INSTALLATION OF FLEXIBLE DUCTWORK**

A. Ductwork shall be installed with spin-on fittings with integral volume damper for connection to branch duct. Connection to terminal supply device shall be through a coupler specifically designed to lock into device employed. Flexible insulations shall be attached to rigid duct and/or couplers with coupler clamp.

B. Installed lengths of flexible ductwork shall be limited to 5'-0" maximum lengths. When longer distances between terminals and branch ducts are encountered, the balance shall be made up of rigid sheet metal sections of construction hereinbefore specified.

**3.04 DRAWINGS**

A. In general the drawings of the Mechanical Systems and equipment are to scale, however, to determine exact locations of walls and partitions the Contractors shall consult the Architectural and/or Structural drawings which are dimensioned. Drawings shall not take precedence over field measurements.

B. Drawings of piping and ductwork 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 or Engineer may require any or all contractors to change the location or arrangement of their work without additional cost to the Owner. Such rearrangement shall be in accordance with directions from the Architect or Engineer.

C. Where discrepancies are discovered after certain portions or phases of any contract have been installed, the Architect or Engineer reserves the right to require any or all Contractors to make minor changes in pipe, duct, fixture or equipment locations or arrangements to avoid conflicts with other 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. Contractors shall furnish all incidental labor, material or equipment for the systems in their control so that each system is a complete and operating one unless otherwise specifically stipulated in the detailed body of the specifications.

**3.05 DUCT SLEEVES AND CURBS**

A. Provide sleeves for all duct penetrations through floors and walls.

B. Internal dimension of duct sleeve shall be large enough to encompass duct with insulation and packing material.

C. Comply with Division 03.

D. Provide curbs around entire duct assembly penetrating floors in mechanical penthouse.
1. Curb shall surround entire duct assembly.
2. Curb shall be integrated with floor and extend 3-1/2” above floor.
3. Curb shall be 3-1/2” thick.
4. Both sleeve and curb shall be required.

**3.06 AIR DISTRIBUTION DUCT LEAKAGE TEST**

A. This Contractor shall perform testing to insure tightness and construction of ducts and equipment. Leakage tests shall continue with progress of sheet metal installation.
1. Supply duct shall be considered that portion of the supply air distribution ductwork extending from the AHU fan outlets to and including the Air Valves.
2. Return air ductwork shall be considered that portion of the return air distribution ductwork extending from the return grille or register to the connection at the AHU fan casing.
3. Ductwork shall be tested regardless of its pressure classification. Refer to fan schedule on drawings and test ductwork for 1-1/2 times the listed system pressures.

B. Duct testing procedure shall conform to the Minnesota Energy Code which references SMACNA Duct Leakage Test Procedure – 1985 in the HVAC Air Duct Leakage Test Manual.

C. This Contractor shall provide all test equipment that should include the following:
1. Air source of high pressure air.
   a. Rotary type blower fan.
2. Device to measure total air flow accurately.
   a. Calibrated orifice plate.
   b. Air straightening vanes.
   c. Pressure tap and receptacle tube and dampering section.
3. Instruments
   a. Magnehelic gauge.
   b. U-tub monometer.
   c. Incline gauge.
4. These items shall be assembled on a portable device.

D. Field Test Procedures
   1. Seal all openings in duct section to be tested.
   2. Connect test apparatus to test section of duct.
   3. Close damper on blower suction side to prevent excessive buildup of pressure.
   4. Start blower and gradually open damper on suction side of blower.
   5. Build up pressure in duct test section to 1-1/2 times the maximum operating pressure listed in the fan schedule on the drawings.
   6. Read indicated pressure on instrument that is connected to section of duct under test.
   7. Maintain this pressure for ten minutes which will indicate audible leaks.
   8. Reduce pressure to operating pressure and make survey. Repair all visual and audible leaks. Shut down blower and release pressure when making repairs.
   9. Upon completion of repairs, build up pressure to design operating pressure, and read leakage pressure on instrument connected across test apparatus orifice plate.
   10. Leakage CFM is read by consulting a calibrated chart. If no leakage exists, zero pressure differential will be indicated.

E. Test Verification
   1. The Sheet Metal Contractor shall engage the services of an independent air balancing test agency to verify test results and submit a certification certificate attesting to the results obtained. Arrangements shall be made between contractor and agency to coordinate the field test of installed sections of ductwork. Test results and verification shall be recorded and submitted on standard test forms.
   2. Tested sections of ductwork shall be visually marked by agency with certification sticker and initial of field test inspector. Tests shall be made before duct sections are concealed.

**END OF SECTION**

**SECTION 233300**

**AIR DUCT ACCESSORIES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Combination fire and smoke dampers.

C. Duct access doors.

D. Flexible duct connections.

E. Volume control dampers.

F. Motorized dampers.

### 1.02 RELATED DOCUMENTS

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

B. Section 230548 - Vibration Controls for HVAC Piping and Equipment.

C. Section 230913 – Instrumentation and Control Devices for HVAC Controls: Control damper operators.

D. Section 233100 - HVAC Ducts and Casings.

### 1.03 REFERENCES

A. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems; National Fire Protection Association; 2002.

B. NFPA 92A - Standard on Smoke-Control Systems; National Fire Protection Association; 2006.

C. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

D. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; 2003.

E. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; 2006.

F. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; 1999.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements. Indicate arrangement, velocities, and static pressure drops for each control damper.

C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

D. Manufacturer's Installation Instructions: Provide requirements for access to fire dampers, F/S dampers, and control dampers.

**1.05 PROJECT RECORD DOCUMENTS**

A. Record actual locations of access doors.

**1.06 DELIVERY, STORAGE, AND HANDLING**

A. Protect dampers from soiling and damage to frames, operating linkages, blades, and accessories.

**PART 2 PRODUCTS**

**2.01 AIR TURNING VANES**

A. Turning vanes shall be well braced and rough or raw edges shall be avoided to prevent objectionable noise; they shall be the double thickness type and shall be the same gauge as the duct in which they are installed. Vanes shall be preassembled on runners before being installed in the elbow. Vanes shall conform to the following table:

| Duct Width Inches | Vane Spacing Inches | Inside Blade Radius Inches | Outside Blade Radius Inches | Runner Width Inches |
|---|---|---|---|---|
| Up to 25 | 1-1/2 centers | 2 | 1 | 2-1/4 |
| Above 25 | 3-1/4 centers | 4-1/2 | 2-1/4 | 4-1/2 |

B. Acceptable Manufacturers:
1. Ductmate
2. Sheet Metal Connectors Inc.
3. Aero Dyne
4. Approved equal

**2.02 COMBINATION FIRE AND SMOKE DAMPERS**

A. Performance: 1-1/2 hour rated UL Standard 555 S, Class II

B. Frame: 16 gauge galvanized steel.

C. Blade type: Triple vee construction, 6" wide, galvanized steel.

D. Linkage: Parallel blade.

E. Bearings: Stainless steel or bronze oilite pressed into frame.

F. Fusible Link: 165 degrees F.

G. Position Switch: One switch to prove the damper is open, a second switch to prove damper is closed.

H. Electric Damper Motor
1. Two position, spring return.
2. 60 lb.-in. torque.
3. Internal limit switch to de-energize motor when damper is in open position.
4. Non-stall type motor.
5. Electric brake coil to hold damper motor in open position. Unit power consumption shall be 10W in the open position.
6. Damper linkage and mounting hardware.
7. U. L. Listed.
8. Auxiliary SPST switch mounted within enclosure.
9. Manufacturer: Honeywell ML Series with auxiliary spst switch (120V, 208V, 240V).

I. Acceptable Manufacturers:
1. Ruskin FSD36
2. PREFCO 5020 (Class II Option)
3. Ruskin FSDR25
4. Greenheck FSD 22
5. Cesco FSD2B.

**2.03 DUCT ACCESS DOORS**

A. Where motorized dampers, fire dampers, control equipment, etc. are installed in ducts, provide access panels made airtight with gasketed edges. Use sponge rubber or felt gasketing material. The panels shall be attached to the duct with cam latches. The access panels shall be of adequate size to permit maintenance of the equipment.

B. Acceptable Manufacturers:
1. Cesco
2. Nailor Industries, Inc.
3. Ruskin Company

**2.05 FLEXIBLE DUCT CONNECTIONS**

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq. yd.
a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gauge thick galvanized steel.

**2.06 VOLUME CONTROL DAMPERS**

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards

B. This Contractor shall furnish and install the required air devices necessary to produce the specified air volume without excess air resistance or noise. Butterfly or splitter dampers shall be installed at all branch take-off locations so that the air volume can be adjusted in both the

branch and trunk duct. Dampers shall be reinforced to prevent vibration and shall be equipped with approved damper rods, quadrants and locking devices. Quadrants shall be marked to indicate damper position. Where ducts are insulated, quadrants shall be set to finish flush with insulation. Volume dampers in ductwork located above in accessible sheet rock ceilings shall be provided with concealed type regulators mounted in ceiling with flush chrome plated cover. Damper material shall be the same as adjacent ductwork. Volume dampers located above gypboard ceiling shall have extended shaft to operate straight or 90 degree angle drive sets from a concealed style regulator set with hex nut. DuroDyne Model Nos. SRC-140, SRC-380, SRC-120.

C. Additional dampers may be required and shall be provided by this Contractor in ducts to balance air system. They shall be of the louver type, opposed blade with 6" maximum width, indicated damper position, channel welded frames and iolite brass bearings.

D. Branch take-off sizes on drawings shall be strictly adhered to and if deviations are necessary due to construction conditions, the Architect/Engineer shall be contracted before installation is made.

E. Acceptable Manufacturers:
1. Cesco
2. Nailor Industries, Inc.
3. Ruskin Company
4. Greenheck
5. Safe Air

**2.07 VERY LOW LEAK DAMPERS**

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Extruded aluminum not less than .080" thick, 4" deep insulated with polystyrofoam. Flanged in duct.

C. Blades: Extruded aluminum, maximum blade size 6 inches wide. Extruded aluminum internally insulated, thermally broken.

D. Linkage: Parallel or opposed blade.

E. Bearings: Compared of a Celcan inner bearing fixed to a 7/16" aluminum blade pin, rotating within a polycarbonate outer bearing inserted in the frame.

F. Blade gaskets and frame seal shall be silicone.

G. Leakage: Less than 3 CFM/square foot at 1" w.g.

H. Acceptable Manufacturers:
1. Tampco Series 9000 SC

**PART 3 EXECUTION**

**3.01 PREPARATION**

A. Verify that electric power is available and of the correct characteristics.

**3.02 INSTALLATION**

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 3100 for duct construction and pressure class.

B. Provide motorized dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

E. Provide combination fire and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install combination smoke and fire dampers in accordance with NFPA 92A.

G. Demonstrate resetting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct takeoff. Additional damper may be required and shall be provided by this Contractor in ducts to balance air system. Branch take-off sizes on drawings shall be strictly adhered to and if deviations are necessary due to construction conditions, the Architect/Engineer shall be contracted before installation is made.

K. Use splitter dampers only where indicated.

L. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

**END OF SECTION**

**SECTION 233413**

**HVAC FANS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Centrifugal fans.

B. Inline centrifugal fans.

C. Power roof ventilation.

D. Fan accessories.

### 1.02 RELATED DOCUMENTS

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

B. Section 230513 - Electrical Motor Requirements for HVAC Equipment.

C. Section 230913 - Instrumentation and Control Devices for HVAC.

D. Section 230548 - Vibration Controls for HVAC Piping and Equipment.

E. Section 230713 - Duct Insulation.

F. Section 233300 - Air Duct Accessories.

### 1.03 REFERENCES

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 1990 (R2000).

B. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2003.

C. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 1999 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

D. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/licenses/search.aspx.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2005.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc.; 2005.

G. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and

Air Conditioning Contractors' National Association; 2005.

**1.04 PERFORMANCE REQUIREMENTS**

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. Fabrication: Conform to AMCA 99.

D. Temperature Limit: Maximum 300 degrees F.

E. Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

**1.05 SUBMITTALS**

A. Comply with requirements of Division 1.

B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.

D. Manufacturer's Instructions: Include complete installation instructions.

E. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

**1.06 QUALITY ASSURANCE**

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

**1.07 DELIVERY, STORAGE, AND PROTECTION**

A. Protect motors, shafts, and bearings from weather and construction dust.

**1.08 ENVIRONMENTAL REQUIREMENTS**

A. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

**PART 2 PRODUCTS**

**2.01 CENTRIFUGAL FANS**

A. Housing and Frame
   1. Continuously welded steel.
   2. Braced with welded steel members to prevent vibration.

3. Inlet cone with inlet collar.
4. Discharge collar.
5. Primed and coated with baked enamel.

B. Drive
1. Polished solid-steel shaft.
2. Welded steel bearing supports.
3. Heavy duty grease lubricated ball or roller pillow block bearings with 200,000 hour life.
4. Extended lube lines.
5. Fixed pitched sheaves – Fans with variable frequency drive - Variable pitch sheaves – constant volume fans

C. Fan
1. Single width, single inlet
2. Class I or II.
3. Statically and dynamically balanced.
4. Belt guard (if belt drive is required).
5. AMCA rated and certified.

D. Motor
1. Grease lubricated bearings.
2. Open drip proof construction.

E. Miscellaneous
1. Fan inlet screen.
2. Fan housing access door.
3. Vented weather cover to meet UL 705.

4. AMCA Type A spark-proof construction with all parts in airstream fabricated from aluminum.

F. Acceptable Manufacturers:
1. Penn Barry
2. Cook
3. Greenheck
4. Twin City Fan
5. Peerless

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install fans with resilient mountings and flexible electrical leads. Refer to Section 220548.

C. All fans shall have proper belt guards.

D. Furnish all support beams, angles, stands, etc. to install equipment specified in this section.

E. Turn roof curbs over to Division 7 contractor for installation.

F. Provide vibration isolation as specified in Section 230548.

G. Install flexible connections between fan inlet and discharge to ductwork; refer to Section 233300. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

H. Provide sheaves required for final air balance.

**END OF SECTION**

**SECTION 233700**

**AIR OUTLETS AND INLETS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

C. Louvers

### 1.02 RELATED DOCUMENTS

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

### 1.03 REFERENCES

A. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

### 1.04 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

## PART 2 PRODUCTS

### 2.01 GRILLES, REGISTERS, DIFFUSERS AND AIR CONTROL DEVICES

A. Diffusers other than stainless steel shall be prime coated and finished with baked-on white enamel finish. Grilles and registers shall be aluminum or steel prime coated and finished with baked-on white enamel finish. The various grilles, registers and diffusers are indicated on the drawings by alphabetical letters according to the schedule on drawings.

B. This Contractor shall determine frame styles by referring to the Architectural Drawings. Where ceilings are exposed grid lay-in type, frame styles shall be lay-in type.

C. Acceptable Manufacturers:
1. Tuttle & Bailey
2. Titus
3. Carnes
4. Anemostat
5. Krueger
6. J. J. Register
7. E. H. Price

**2.02 LOUVERS**

A. General. Stationary, 6 inch, aluminum with drainable blade.

B. Frame: Extruded aluminum, .081 inch wall thickness or greater, caulking slots.

C. Blades: Extruded aluminum, .125 inch wall thickness, 37-1/2 degrees on 5-29/32 inch centers with drain gutter in each blade.

D. Screen: Aluminum 3/4" x 3/4"

E. Finish: Baked enamel

F. Sill: Extended front sill.

G. Performance (based on 48" x 48") AMCA certified.
1. Free area - 57% or greater
2. Max velocity thru free area - 1000 fpm
3. Pressure drop at max velocity - .10 in w.g.
4. Water penetration at max velocity - .01 oz. per sq. ft. free area, 15 min.

H. Acceptable Manufacturers
1. Ruskin ELF6375DX
2. Approved equal.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

**3.02 LOUVER**

A. Coordinate with architectural drawings for exact dimensions.

B. Blank off with 2” insulated double wall housing all unused portions of louver.

C. Provide Architect with color selection chart for final color selection.

**END OF SECTION**

**SECTION 234000**

**HVAC AIR CLEANING DEVICES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Disposable panel filters.

### 1.02 RELATED DOCUMENTS

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

B. Section 230519 – Meters and Gauges for HVAC

C. Section 237313 – Modular Indoor Central-Station Air-Handling Units

### 1.03 REFERENCES

A. ARI 850 - Commercial and Industrial Air Filter Equipment; Air-Conditioning and Refrigeration Institute; 2004.

B. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc.; 2004.

### 1.04 PERFORMANCE REQUIREMENTS

A. Conform to ARI 850 Section 7.4.
   1. Dust Spot Efficiency: Plus or minus 5 percent.

### 1.05 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

## PART 2 PRODUCTS

### 2.01 2 INCH 30% EFFICIENCY

A. Air filters shall be 2" thick MERV 8, pleated, disposable type. Each filter shall consist of a non-woven cotton fabric media, media support grid and enclosing frame. The filter shall be listed by Underwriters' Laboratories as Class II.

B. The effective filter media shall be not less than 4.6 square feet of media per 1.0 square foot of filter face area. Initial resistance at 500 fpm approach velocity shall not exceed .40" WG.

C. The media support shall be a welded wire grid with an effective open area of not less than 96%. The welded wire grid shall be bonded to the filter media to eliminate the possibility of media oscillation and media pull away. The media support grid shall be formed in such a manner that it affects pleat design, allowing total use of filter media.

**2.02 FILTER MANUFACTURERS**

A. American Air Filter

B. Camfil Farr Company

C. Tri-Dim Filter Company

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

**END OF SECTION**

**SECTION 236200**

**PACKAGED AIR COOLED REFRIGERANT COMPRESSOR AND CONDENSING UNIT**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Condensing units.

D. Valves.

E. Evaporator units.

F. Check valves.

### 1.02 RELATED DOCUMENTS

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

### 1.03 REFERENCES

A. ARI 710 - Performance Rating of Liquid-Line Dryers; Air-Conditioning and Refrigeration Institute; 2004.

B. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Driers; Air-Conditioning and Refrigeration Institute; 2005.

C. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2004.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; The American Society of Mechanical Engineers; 2001.

F. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2004 (ANSI/ASME B31.9).

G. ASTM B 280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2003.

H. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.

**1.04 SYSTEM DESCRIPTION**

A. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gage taps at compressor inlet and outlet.
   3. Use check valves on compressor discharge.

**1.05 SUBMITTALS**

A. Comply with requirements of Division 1.

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Test Reports: Indicate results of leak test, acid test.

E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

F. Submit welder's certification of compliance with ASME (BPV IX).

**1.06 REGULATORY REQUIREMENTS**

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

C. Welders Certification: In accordance with ASME (BPV IX).

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

**1.07 DELIVERY, STORAGE, AND HANDLING**

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

## PART 2 PRODUCTS

### 2.01 PIPING

A. Copper Tube: ASTM B 280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

### 2.02 COMPRESSOR/CONDENSING UNITS

A. Provide where shown on drawings packaged compressor-condensing units. The refrigeration unit shall be factory assembled on a single base. Unit shall be factory performance tested under normal operating conditions. Units shall be shipped prewired ready for refrigerant and electrical connections. Unit shall have a cooling capacity of, as shown on the drawings, gross refrigeration effect at 95 degrees ambient temperature and 45 degrees saturation suction temperature. Unit shall be complete with casing, compressors, condenser, fans, motors and controls.

B. Unit Casings - Condensing units shall be designed for outdoor application and shall provide complete protection for all components and controls. Casings shall have panels to provide complete access to compressor, controls, condenser fans, motors and drives. The unit shall be shipped complete in one section as a factory assembly.

C. Compressor - Compressor shall be of accessible hermetic type, 1750 rpm and designed for air-cooled condensing. Lubrication shall be of the forced feed type with positive displacement reversible oil pump, crankcase sight glass, and crankcase heater. Backseating service access valves shall be provided on suction and discharge ports. Compressor shall provide capacity control through cylinder unloading and hot gas bypass. Provide five-year warranty.

D. Control - Condensing unit operating and safety controls shall include high pressure cutout, low pressure cutout, oil pressure cutout, and compressor winding thermostat cutout, ambient lockout, minimum run timers. Control panel shall include magnetic starters for compressor and condenser fan motors.

E. Condensing Section - Condenser coil shall be of seamless copper tubing mechanically bonded to heavy duty aluminum fins. A liquid accumulator and subcooling circuit shall be included as a standard part of the condensing section. Unit shall be equipped with a backseating liquid line service access valve. Condenser coils should be factory tested at 425 psig air pressure under water and vacuum dehydrated at 175 degrees F.

F. Condenser Fans and Drives - Condenser fan shall be of the propeller type with all exposed fan and shaft surfaces suitably weatherproofed separated by baffles. Condenser fan shall provide vertical air discharge. Motors shall be direct drive. All three phase motors for mechanical equipment rated one horsepower and larger shall meet NEMA Premium Efficiency standards NEMA Standard MG1-2003.

G. Acceptable Manufacturers:
   1. Trane
   2. McQuay
   3. Carrier

## PART 3 EXECUTION

### 3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

### 3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

G. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 083100.

H. Flood piping system with nitrogen when brazing.

I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

J. Insulate piping and equipment; refer to Section 230716 and Section 230719.

K. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

L. Fully charge completed system with refrigerant after testing.

M. Provide 4" concrete pad or mounting frame for locating compressor/condenser units. Set units in place, level and secure to pad.

### 3.03 REFRIGERANT PIPING TESTS

A. Leak tests shall be made before installed on piping. Tests shall be conducted using nitrogen, at 250 psi on the high side, and 160 psi on the low side of the system.

B. After completion of the above tests, apply a 28" (Hg) vacuum to the entire system; no more than a 5" change will be accepted after 24 hours.

**3.04 DEMONSTRATION AND TRAINING**

A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation, and troubleshooting of the installed systems.

**END OF SECTION**

**SECTION 238219**

**FAN COIL UNITS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. PTAC units.

B. VTAC units.

### 1.02 RELATED DOCUMENTS

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

C. Section 230513 - Electrical Motor Requirements for HVAC Equipment.

D. Section 230913 - Instrumentation and Control Devices for HVAC

E. Section 230993 - Sequence of Operations for HVAC Controls

### 1.03 SUBMITTALS

A. Comply with requirements of Division 1.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
3. Indicate mechanical and electrical service locations and requirements.

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Operation and Maintenance Data: Include manufacturer’s descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

F. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

### 1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### 1.05 WARRANTY

A. Comply with requirements of Division 1.

## PART 2 PRODUCTS

### 2.01 PTAC UNITS (HORIZONTAL)

A. Furnish and install where shown on drawings vertical stacking fan-coil units. Unit sizes, performance and equipment shall be as tabulated in the schedule.

B. Unit Configuration - Unit shall be electric cooling, electric heating system. The unit shall have two fans, two compressors and two stage heat, with all components necessary for the systems. Two stages are required for continuous 24 hours per day, 7 days per week operation of the units, to deliver outside air. Filter, fan assembly, drain pan, line, coils and motor, etc. shall be easily accessible and removable. Internal controls, room side freeze protection, with a remote Thermostat.

C. Cabinet shall be fabricated of heavy-gauge galvanized steel and fully insulated with 1/2 inch multi-density glass fiber. An insulated galvanized steel access and sound baffle panel shall completely enclose the coils section. The snap-on return air grille panel shall be heavy-gauge galvanized steel with a stamped (bar type) grille and electrostatically applied baked semi-gloss finish color selected by Architect/Engineer. A plaster frame will be provided to hold the return air grille panel away from the wall when the unit is furred in. Provide top duct collar opening except where noted.

D. Coils shall be ARI certified, standard type "A" cooling coil (low flow cooling coils). All coils shall be 5/8 inch O.D. seamless copper tubes in a staggered pattern with rippled and corrugated aluminum fins. Tubes shall be mechanically expanded into the fin collars for positive fin-to-tube bond. Coils shall have manual air vents. Internal pipe shall allow for vertical riser expansion of 1/2 inch. Coil performance shall be as tabulated in the schedule. Coil shall be positioned to provide positive condensate drainage. Provide condensate removal kit and accessories. Condenser coil shall discharge directly through the exterior wall.

E. Fan Assembly - Fan housings shall be two-piece galvanized steel with integral scroll and inlets. Fan wheels shall be DWDI forward curved centrifugal direct drive type. All fan wheels shall be statically and dynamically balanced.

F. Motors shall be permanent split capacitor type with sleeve bearings, oilers, inherent thermal overload protection with automatic reset and resilient mounts.

G. Drain pan shall be galvanized steel with drain line and sprayed-on closed cell insulation on the internal and external surfaces to prevent condensation.

H. Filters - Filters shall be nominal one-inch thick throwaway.

I. Louvers – Refer to the Architectural documents.

J. Controls - See Section 230993 - Sequence of Operation.

K. Manufacturer: Islandaire – Dr. PTAC.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. PTAC and VTAC Units: Install as indicated. Coordinate to assure correct recess size for recessed units.

**3.02 CLEANING**

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

**END OF SECTION**

**SECTION 260500**

**GENERAL REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SCOPE

A. Conditions of the Contract (General and Supplementary Conditions) and Division 1, General Requirements, govern Work of this Section.

B. Work included in Division 26, 27, and 28 of the specifications consists of furnishing all labor, equipment, supplies and materials unless otherwise specified, and in performing all operations necessary for the installation of the complete electrical system as required by these specifications or shown on the drawings, subject to the terms and conditions of the Contract. The work shall also include the completion of details of the electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems indicated on the drawings or specified herein.

### 1.02 EXAMINATION OF SITE

A. Contractor shall examine the site and become familiar with all local conditions prior to submission of the bid. Contractor shall be considered to accept all visible conditions existing at the site at the time of bidding and no extra compensation will be allowed for difficulties encountered which are existing and visible at the site at time of bidding.

### 1.03 CODES AND STANDARDS

A. The entire installation shall meet all requirements of the most recently adopted edition of the National Electrical Code, NFPA 70, and amendments thereto and all State and local regulations as they may apply. Standards of the following associations or organizations shall be followed and applied where applicable as minimum requirements.

ADA - Americans with Disabilities Act
SBC - State Building Code
OSHA - Occupational Safety and Health Act
NFPA - National Fire Protection Association
NBFU - National Board of Fire Underwriters
UFC - Uniform Fire Code
IBC - International Building Code
IFC - International Fire Code
NEC - National Electrical Code

B. Comply with all Holiday Inn Express standards.

### 1.04 PERMITS AND LICENSES

A. Permits and licenses applicable to the electrical work shall be secured and paid for before actual work is started. Perform any requirements stipulated therein.

B. Comply with requirements of Division 0.


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**1.05 TEMPORARY CONSTRUCTION LIGHT AND POWER**

A. Comply with requirements of Division 1.

B. Construction Power and Lighting Service.
   1. As soon as the contract is awarded, Electrical Contractor shall arrange for a 200 ampere, 120/240 volt, 1 phase, 3 wire overhead service. The Utility Company shall provide overhead temporary services from the existing property line Utility Company pole line to terminal metering pole located within the construction limits. Provide terminal-metering pole, service drop connectors and meter socket.
   2. Provide service switch, fuses and all conduit and wire, distribution equipment including groundfault protection devices.
   3. Remove temporary construction light and power provisions at end of project or when transfer is made to the permanent service/distribution system.
   4. Construction electrical energy shall be paid by the General Contractor.
   5. Temporary security lighting shall be the responsibility of the General Contractor.
   6. All Utility Company fixed temporary service charges, including intermediate poles, connect/disconnect costs and metering shall be paid by the Electrical Contractor.

C. Materials
   1. Materials for the construction light and power system need not be new and need not conform to the provisions found elsewhere in these specifications relating to materials for the permanent installation. However, material shall be in good condition and of quality to assure adequate operation and safety of use and shall have the listed approval of Underwriter's Laboratories, Inc. where applicable.
   2. Temporary receptacles, except where noted otherwise, shall be 15 ampere, 120 volt, duplex grounding type with groundfault interruption, and shall be installed in suitable outlet boxes with plates.
   3. Temporary lights, except noted otherwise, shall consist of medium base rubber pigtail type light sockets or of porcelain lampholders on suitable outlet boxes.
   4. Temporary conductors where open wiring is permitted shall be copper or aluminum and except for grounding conductor shall be insulated. Sizes of feeder wiring/conduit shall be as per load. Sizes of branch circuit conductors shall be No. 12 AWG minimum size, except where the branch circuit length exceeds 200 feet shall be increased. Splices of temporary conductors shall be soldered or shall utilize approved types of mechanical connections and all splices shall be insulated by taping or other approved methods.
   5. Materials furnished by the Electrical Contractor for the preceding temporary system shall remain his property and shall be removed where there is no longer any need for temporary light and power.

D. Installation
   1. Installation of the construction light and power system shall comply with requirements of applicable codes and ordinances as they relate to such temporary wiring.
   2. Except as otherwise provided here, completed portions of the permanent installation or materials for use in the permanent installation shall not be used in the temporary work without specific permission of the Architect/Engineer.
   3. Grounding shall comply with applicable codes relating to permanent work. Grounding terminals of receptacles and non-current-carrying metal parts of equipment of the construction light and power system shall be connected to the common grounding conductor at the service through metallic conduits or through grounding conductors installed with circuit conductors. The permanent grounding system may be utilized for the temporary system.


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4. Overload protection for circuits and equipment of the construction light and power system shall comply with applicable codes relating to permanent work. Load protection centers and other protective equipment shall be furnished and installed as shown on the electrical drawings or as required by field conditions.
5. Each individual subcontractor shall provide his own extension cords as required for use of temporary electrical service. Extension cords must conform to Industrial Commission safety requirements.

E. Loads
1. The maximum individual load which may be connected to the system is as follows:
   a. 120 volt, 1 phase, 1.5 kva load.
   b. 240 volt, 2 phase, 3.0 kva load.
2. Parties wishing to use electric welders and other equipment requiring power over loads defined above shall provide and pay for additional temporary service required. Coordinate with the General Contractor.
3. Personnel and material lifts, cranes, etc. shall have separate temporary power provided by others.

**1.06 INSPECTION**

A. The installation shall be made by persons licensed and skilled in the trade and shall be done under the supervision of a master electrician. The work will be inspected by the local or other authorized electrical inspection agency.

**1.07 SUBMITTALS**

A. Materials List, Cost Breakdown, Progress Schedules and Substitutions.
1. Comply with requirements of Division 1.
2. Provide individual submittals for each specification section consisting of separately bound paper files or electronic files to allow proper logging in of shop drawing submittals. Submittals received as combined paper files or electronic files will be returned to contractor for proper processing. Provide a separate transmittal with each specification section submittal.

**1.08 DRAWINGS**

A. Comply with requirements of Division 1.

**1.09 QUALITY AND WORKMANSHIP**

A. All materials and equipment furnished under this contract shall be new, free from defects and shall be listed by the Underwriter's Laboratories, Inc., or other nationally recognized testing laboratory as conforming to its standards in every case where such a standard has been established for that particular type of material or equipment.

B. All materials and finishes shall be adequately protected during construction from moisture, temperature extremes and physical abuse. All materials shall be assembled in a workmanlike manner in accordance with current recommended standard practice.

C. Miscellaneous equipment, pull boxes, junction boxes, fittings, and expansion joints, necessary to complete the work satisfactorily shall be furnished and installed even though not specifically shown on drawings.


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## 1.10 DIMENSIONS AND CORRELATION

A. For the purpose of clarity and legibility the drawings are essentially diagrammatic and are intended to indicate size, capacity and location but not exact details or arrangements of construction. Architectural, mechanical and structural drawings shall be examined so that all details of the project are understood and work procedures known before bidding and installation. Any discrepancies between Architectural, Mechanical and Electrical drawings shall be reported in writing to the Architect/Engineer. Exact locations and details shall be obtained from dimensioned drawings but shall not take precedence over field dimensions.

B. Cooperate with other contractors for proper anchorage, placement and accomplishing of all work. Interference between the work of the various contractors shall be resolved before installation. In the event of conflict of space requirements or location with other trades, refer the matter to the Architect/Engineer for decision.

## 1.11 CUTTING AND PATCHING

A. Cutting and patching excluding finish painting, required for electrical work shall be the responsibility of this Contractor. Cutting and patching shall be kept to a minimum by the proper placement of the materials. General Contractor will perform all finish painting.

B. No cutting shall impair the strength of any part of the building. No cutting or drilling shall be done without the Architect/Engineer's permission and instruction.

C. Workmen employed to do the patchwork shall be tradesmen skilled in the particular trade involved. The quality of the workmanship must be of the best, and work shall restore the structure and surfaces to a new condition or to match the existing adjoining work, using materials and methods consistent with the general construction requirement specification.

D. Comply with all requirements of Division 1 and Division 9.

## 1.12 EXCAVATION, BACKFILL, AND CONCRETE

A. Provide all trenching, excavation and backfill required for the electrical work. Repair all streets, sidewalks, curbs or paved areas damaged because of electrical work. All sub-surface and finished surfaces shall be constructed equal to existing condition of adjacent materials. Sodding and seeding of grass areas will be performed by the General Contractor.

B. Where concrete work is provided by Division 26 concrete shall have a compression strength of 3000 psi at 28 days per ISO 3893:1997 classification standard unless otherwise noted.

C. Comply with requirements of Division 31.

## 1.13 CLEANING

A. Clear away debris, surplus materials, etc., resulting from work and operations, leaving the job and equipment furnished under contract in a clean and first-class condition.

B. Equipment Cleaning
   1. Exterior enclosure surfaces of electrical equipment shall be wiped or vacuum cleaned to remove construction debris and dust.
   2. Enclosure interiors of electrical equipment, light fixtures, etc., shall be cleaned to remove construction debris and dust.


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3. Accessible elements of disconnecting and protective devices of equipment and the like shall be exposed to compressed air less than 15 psi and vacuum cleaned prior to being energized.

C. Comply with requirements of Division 1.

## 1.14 PAINTING

A. Painting of exposed conduits, pull and junction boxes, and panelboards and terminal cabinets will be by the General Contractor.

B. Refinish and restore to their original condition electrical equipment which has sustained damage to the manufacturer's prime and finish coats of paint or enamel. Materials and workmanship shall be equal to the requirements of Section 09900.

## 1.15 TESTS AND DEMONSTRATIONS

A. All work hereunder shall, upon completion be subjected to such tests as are required under industry standards and/or specified herein, and acceptance of the work by Owner shall be contingent upon satisfactory completion of these tests.

B. All portions of the work shall be subjected to a careful and thorough visual inspection to detect insofar as possible, any erroneous or loose connections, damaged components, presence of foreign objects or materials, poor workmanship, incorrect rating of overcurrent protective devices, or other abnormal conditions.

C. Tests required before energization of systems:
1. Ground resistance tests.
2. Insulation resistance tests for feeders, 600 volt or less, with megger applying a test potential of 500 volts D.C.
3. Operational checks to demonstrate proper functioning of lighting equipment, controls, proper rotation for motors, proper operation of meters, instrumentation, metering, etc.
4. Tests for special systems, fire alarm, etc., shall be performed by the vendor's qualified representative. These tests shall be witnessed by the Engineer and written test reports shall be provided. Submit system operational certification letter from the manufacturer.

D. Demonstrate and instruct the essential features of all electrical control, special systems, communication systems and generation systems upon completion of satisfactory testing. The demonstration and instruction shall be held as a responsibility of the contractor by authorized manufacturer's personnel in the presence of the Owner or his designated representatives and the Architect/Engineer to show functions, locations and relationships to the drawings.
1. Instructions shall be provided for the following equipment and systems:

Electrical Distribution System
Emergency Lighting and Power System
Fire Alarm System
Lighting Control Systems
Motor Controls
Building Security System
Communication/Signal/Alarm Systems

E. Provide third party testing and certification of the essential electrical system in accordance with NFPA 99. Submit as required to local and State authorities. Submit copy to Engineer.


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## 1.16 CONTRACT CLOSEOUT

A. Maintenance Manuals and Record Drawings.
   1. Comply with requirements of Division 1.

## 1.17 WARRANTIES

A. Comply with requirements of Division 1 and General Conditions where required.

**END OF SECTION**


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**SECTION 260519**

**LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)**

## PART 1 GENERAL

### 1.01 SCOPE

A. This section includes the furnishing, installation and connection of the low voltage power and branch circuit wiring.

B. Unless otherwise specified in other sections of these specifications, control wiring shall be provided, installed and connected to perform the functions specified in other sections of these specifications.

C. Unless otherwise specified in other sections of these specifications, communication and signal wiring shall be provided, installed and connected to perform the functions specified in other sections of these specifications.

### 1.02 RELATED SECTIONS

A. Division 31 - Earthwork

B. Section 260500 - General Requirements

C. Section 260526 - Grounding and Bonding for Electrical Systems

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Building Wire/Cable: Aetna, American, Anixter, Cablec, Capital, Carol, Collyer, Manhattan, Pierce, Perelli, Rome, Seicor, Southwire or Superior Essex.

B. Twist Connectors: Heyco, Ideal, 3M or T & B.

C. Plastic Tape: AMP, Eagle, 3M or Okonite.

D. Connectors Mechanical: Burndy, Greaves, Square D, or T & B.

E. Prefabricated, wirenut “pigtails”: Ideal Industries, Inc. “Term-a-Nut”, or equal.

F. Prefabricated Multi-Wire Armored and Metal-Clad Cables: Interflex-Corra/Clad, AFC


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**2.02 MATERIALS**

A. Cable and Wire:
   1. Cable and wire shall be in accordance with NEMA, ICEA, UL and NEC and as hereinafter specified.
   2. Conductors:
      a. Shall be annealed copper.
      b. Shall be single conductor or stranded conductor for sizes No. 12 and smaller. Where stranded conductors are utilized for branch circuit wiring to devices final connection, the termination onto screw terminals shall use single conductor wire with pigtails to stranded wire.
      c. Shall be stranded for sizes No. 10 and larger.
      d. Size shall be not less than shown on the drawings. Minimum size shall be No. 12 AWG.
      e. Where aluminum conductors are substituted in lieu of copper, at the Contractor's option, for feeders #4 AWG copper and larger, the Contractor shall use connectors, MAC "Mac-Adapt" Series MPT, or T & B equal approved for use with the aluminum conductors, and shall use an electric joint compound, such as Alcoa Alnox, at all terminations and joints. The aluminum conductors and corresponding conduit, if substituted, shall be increased in size from the copper conductor and conduit size shown on the drawings to maintain copper conductor ampacity at the appropriate temperature ratings. Aluminum conductors are not approved for high voltage over 600 volts wiring.
   3. Insulation: Unless otherwise shown on the drawings, insulation shall be as follows:
      a. XHHW, or dual rated THHN-THWN.
      b. Direct burial: UF or USE
      c. Isolated power system wiring: Shall be type XHHW with a dielectric constant of 3.5 or less.
   4. Multi-wire Prefabricated Power Cables:
      a. Armored cable, type AC, not allowed unless otherwise noted or specified on the drawings.
      b. Metal-clad, type MC, may be used for branch circuits only in dry locations where not subject to physical damage per the following requirements:
         1. Cables contain THHN insulated copper conductors including full rated, insulated copper ground conductor.
         2. Cable shall bear UL label and manufacturers "E" number.
         3. Cable shall utilize aluminum or galvanized steel interlocked armor cover.
         4. Rated for two hour fire rating per UL Fire Wall Penetration Test, UL 1479.
         5. Anti-short bushing shall be installed in each cable termination.
         6. Shall not be installed as “home run”, see specification Section 260533, paragraph 3.02, B. for branch circuit home run definition.
         7. Shall terminate with steel, locknut style cable connectors UL listed for use with MC cable.
         8. Jacket-None (unless specified or shown for direct-burial or wet locations, then jacket shall be UV resistant, 40 mil PVC).
         9. Contain separate neutral per phase or single oversized neutral conductor.

   5. Color code:
      a. All secondary service, feeder and branch circuit conductors shall be color coded as follows:


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| 208/120 Volt | Phase | 480/277 Volt |
|---|---|---|
| Black | A | Brown |
| Red | B | Orange |
| Blue | C | Yellow |
| White | Neutral | Gray * |

*or white with colored, other than green, tracer.

b. All No. 12 and No. 10 branch circuit conductors including the neutral shall have solid color compound or solid color coating.
c. No. 8 AWG and larger phase conductors shall have either:
   1. Solid color compound or solid color coating.
   2. Stripes, bands, or hash marks of colors specified above.
   3. Colored pressure-sensitive plastic tape. Tape shall be applied in half overlapping turns for a minimum of three inches for all terminal points and in all junction boxes, pull boxes, troughs, manholes and handholes. Tape shall be 3/4-inch wide with colors as specified above. The last two laps of tape shall be applied with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable stating size and insulation tape.

B. Splices and joints
   1. Shall be in accordance with UL and NEC.
   2. Branch circuits, No. 10 AWG and smaller:
      a. Connectors shall be solderless, screw-on, pressure cable type, 600 volt, 105 degrees C, with integral insulation. They shall be approved for copper and aluminum conductors and shall be reusable.
      b. The integral insulator shall have a skirt to completely cover the stripped wires.
      c. The number, size and combination of conductors, as listed on the manufacturers packaging shall be strictly complied with.
   3. Feeder Circuits:
      a. Connectors shall be indent, hex screw, or bolt clamp-type. Material shall be high conductivity and corrosion-resistant.
      b. Connectors for cable size 250 MCM and larger shall have not less than two clamping elements or compression indents.
      c. Splices and joints shall be insulated with materials approved for the particular use, location, voltage and temperature. Insulation shall be not less than that of the conductors being joined.
      d. Plastic electrical insulating tape.
         1. Fed. Spec. HH-1-595 shall apply.
         2. Tape shall be flame retardant, cold and weather resistant.
   4. Metal-clad cable connectors shall be only UL listed for type MC cable.

C. Control Wiring:
   1. Unless otherwise specified in other sections of these specifications, control wiring shall be as specified for power and lighting wiring, except minimum size may be No. 14 AWG.
   2. Wire size shall be large enough so that the voltage drop under in-rush conditions will not adversely affect operation of the controls.

D. Communication and Signal Wiring:
   1. Shall conform to the recommendations of the manufacturers of the communication and signal systems.


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2. Shall not be less than shown on the drawings.
3. Wiring shown on drawings is for typical systems. Provide wiring as required for the systems being furnished.
4. Multi-conductor cables shall have the conductors color coded.

E. Wire Lubricating Compound:
1. Shall be suitable for the wire insulation and conduit it is used with and shall not harden or become adhesive.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Installation shall be in accordance with the NEC, as shown on the drawings, and as specified herein.

B. Install all wiring in raceway systems. Exceptions shall be pre-manufactured flexible wiring systems with modular connections per NEC 604 and low voltage wire without conduit, if these cable types are contained within this spec.

C. Splice cables and wires only in outlet boxes, junction boxes, pull boxes, or handholes.

D. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

E. For panelboards, cabinets, wireways, switches and equipment assemblies, neatly form, train and tie the cables in individual circuits.

F. Seal cable and wire entering a building from underground between the wire and conduit, where the cable exits the conduit, with a non-hardening approved compound.

G. Wire Pulling:
1. Provide suitable installation equipment to prevent cutting or abrasion by conduits during pulling of feeders.
2. Ropes used for pulling feeders shall be made of suitable nonmetallic material.
3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors.
4. All cables in a single conduit shall be pulled in together.

**3.02 SPLICE INSTALLATION**

A. Splices and terminations shall be mechanically and electrically secure.

**3.03 CONTROL, COMMUNICATION AND SIGNAL WIRING INSTALLATION**

A. Unless otherwise specified in other sections of these specifications, install wiring and connect to perform the functions shown on the drawings and specified in other sections of these specifications.

B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.


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C. Where power supply circuits are not shown for systems, connect them to the nearest panelboards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

D. Install a locking device on the handle of the branch circuit breaker for the power supply circuit for each system to prevent accidental de-energizing of the systems.

E. System voltages shall not exceed 120 volts and shall be lower voltages where shown on the drawings or required by the NEC.

F. Cable and wiring installed without conduit, if approved by the Owner and Engineer, may be installed only above accessible ceilings or areas without ceilings and shall be placed in an orderly manner as high as possible, bundled together as much as possible and secured with plastic ties and anchors a maximum of six feet apart or closer to prevent and eliminate looping or drooping of cables. Cables and wiring shall be secured to the structure or other permanent metallic support systems except for suspended ceiling support wires or sprinkler piping and hangers. Cable and wiring shall be plenum rated if installed in environmental air space. Cables serving a specific system shall not be indiscriminately mixed with cables of another system but shall be bundled and supported discretely and separately from cable serving another system.

## 3.04 METAL-CLAD CABLES

A. Install cables in accordance with manufacturer's instructions and strict accordance with NEC articles.

B. Branch circuit conductors shall be #12 minimum and shall be increased to #10 AWG for 120 volt branch circuits longer than 100 feet or 277 volt branch circuits longer than 200 feet.

C. Exposed cables shall be protected from physical damage.

D. Cables shall be supported every 6 feet for type MC.

E. Where metal-clad type MC cable is used, the metallic sheath shall not be used as the only grounding means. Cable shall contain an internal insulated copper ground conductor properly terminated.

F. Connectors shall be firmly secured to the cable and box.

**END OF SECTION**


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**SECTION 260526**

**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

### 1.01 SCOPE

A. System Grounding
   1. Secondary service neutrals shall be grounded at the supply side of the secondary disconnecting means.
   2. Separately derived systems, transformers downstream from the service entrance, shall have the secondary neutral grounded.
   3. Isolation transformers and isolated power systems shall not be system grounded.

B. Equipment Grounding
   1. All metallic structures, enclosures, raceways, junction boxes, outlet boxes, cabinets, equipment housings and other conductive items in close proximity with electrical circuits shall be grounded for personnel safety and to provide a low impedance path for possible ground fault currents.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below)

C. Section 260533 - Raceway and Boxes for Electrical Systems

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit grounding system test reports.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Grounding, fittings and devices: Burndy, Crouse Hinds, Kearney, Square D, T & B.

B. Exothermic connections - Cadweld or Thermoweld; installed by factory certified personnel.

### 2.02 GROUNDING WIRES

A. Shall be UL and NEC approved types, copper, with THW insulation color identified green, except where bare conductors are shown on the drawings, or specified.

B. Wire size shall not be less than shown on the drawings and not less than required by NEC Article 250-66.


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**2.03 GROUND RODS**

A. Shall be copperclad steel, 3/4" diameter by 10 feet long.

**PART 3 EXECUTION**

**3.01 INSTALLATION, GENERALLY**

A. Grounding shall be in accordance with the NEC, as shown on the drawings, and as hereinafter specified.

**3.02 SECONDARY EQUIPMENT AND CIRCUITS**

A. Main Bonding Jumper
   1. Connect the secondary service neutral to the ground bus in the service equipment.

B. Water Pipe, Concrete Encased Electrode and Supplemental Electrode
   1. Grounding electrode conductor: Provide a connection between the service equipment ground bus and the metallic water pipe system. Jumper insulating joints in the water pipe.
   2. Provide an electrode encased by minimum of 2” of concrete located within and near bottom of footing within direct contact with earth, minimum 20’ length bonded to uncoated rebar minimum 4 AWG copper.
   3. Provide a supplementary ground electrode and bond to the water pipe ground, or connect to the service equipment ground bus.
   4. Where new water services are being added or revised in an existing building, provide connection between the service equipment ground bus and the new metallic water pipe system.

C. Switchboards
   1. Connect the feeder green grounding conductors to the ground bus in the enclosure with suitable pressure connectors.
   2. Connect the grounding electrode conductor to the ground bus.
   3. Connect the neutral to the ground bus or main bonding jumper.
   4. Connect metallic conduits, which terminate without mechanical connection to the housing, by grounding bushings and ground wire to the ground bus.
   5. Connect metallic conduits 2 inch diameter and larger with grounding bushings and grounding conductor to the ground bus.

D. Conduit Systems
   1. Ground all metallic conduit systems. Ground continuity shall be established by using standard couplings, connectors and fittings and jumpers at all grounding type wiring devices, motor and ground terminals.
   2. Non-metallic conduit systems shall contain a grounding conductor.
   3. Conduit provided for mechanical protection and containing only a grounding conductor shall be bonded to that conductor at the entrance and exit from the conduit.

E. Feeders and Branch Circuits: Install green grounding conductors as follows:
   1. All feeders and branch circuits.
   2. All wiring systems using NM, NMC, SER cables without conduit.
   3. All wiring systems consisting of flexible metal conduit.
   4. All items of equipment where the final connection is made with flexible metal conduit shall have a grounding wire.


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5. All additional locations and systems as shown on the drawings.

F. Boxes, Cabinets, Enclosures and Panelboards
   1. Bond the grounding wires to each pullbox, junction box, outlet box, cabinets and other enclosures through which the ground wires pass (except for special or isolated grounding systems).
   2. Provide lugs in each box and enclosure for ground wire termination.
   3. Provide ground bars in panelboards, bolted to the housing, with sufficient lugs for terminating the ground wire.

G. Motors, Starters, and Variable Frequency Drives (VFD)
   1. Provide lugs in motor terminal box and starter housing for ground wire termination and install ground wire between.
   2. Make ground wire connections to ground bus in motor control centers.
   3. For VFD's provide equipment ground wire from drive to motor and from drive to power source. Size ground wire per NEC unless otherwise noted on drawings. Do not run branch circuit to motor and drive in same conduit.

H. Receptacles: Receptacles shall have a ground wire from green ground terminal to the outlet box ground screw, unless circuit is shown or noted to contain a ground wire, in which case ground wire shall terminate directly on green ground terminal.

I. Lighting Fixtures: Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture.

J. Electrical Equipment: Fixed electrical equipment shall have a ground lug installed for termination of the green ground conductor.

K. Exposed interior structural steel that is interconnected to form a steel building frame and is not intentionally grounded and may become energized shall be bonded to the service equipment enclosure, the grounded conductor at the service, the grounding electrode conductor where of sufficient size, or to the one or more grounding electrodes used. The points of attachment of the bonding jumpers shall be accessible.

**3.04 GROUND RESISTANCE**

A. The grounding system shall be tested to insure that the ground resistance does not exceed 5 ohms between any point in the ground system. Use a "Biddle" Grounding Test Meter and use the 3 rod fall-of-potential method to test the grounding electrode system. Submit test reports to the Engineer immediately after testing is completed.

B. Services at power company interface points shall comply with the power company ground resistance requirements.

C. Necessary modifications to the ground electrode for compliance shall be without additional cost.


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**3.05 GROUND ROD INSTALLATION**

A. Distance: Drive each rod vertically for not less than ten feet.

B. Multiple Rods: Where required to obtain the specified ground resistance, install multiple rods.

C. Where ground connections will be permanently concealed, make the connections by the exothermic process to form solid metal joints. Make accessible ground connections with mechanical pressure type ground connectors. Exothermic connections shall be made by technician electrician certified by the manufacturer in the use and installation of exothermic connections.

D. Where rock prevents the driving of vertical ground rods, install grounding electrodes in horizontal trenches to achieve the specified resistance.

**END OF SECTION**


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**SECTION 260533**

**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

### 1.01 SCOPE

A. This section includes the furnishing, installation and connection of conduit, fittings and boxes to form complete, coordinated, grounded or non-metallic ungrounded raceway systems. Raceway is required for all wiring unless specifically indicated or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

### 1.02 RELATED SECTIONS

A. Division 7 - Fire Stopping

B. Division 31 - Earthwork

C. Section 260500 - General Requirements

D. Section 260526 - Grounding and Bonding for Electrical Systems

E. Section 260553 - Identification for Electrical Systems

F. Section 262701 - Electrical Service Entrance

G. Section 262726 - Wiring Devices

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Conduit: Allied, Republic, Wheatland, Alflex, Carlon, Calbrite, Calbond, or Robroy.

B. Surface Metal Raceway: Airey-Thompson, Walker or Wiremold.

C. Metallic outlet junction and pull boxes, fittings and wireways: Appleton, Gedney, Midland Ross, Killark, Raco, Square D, Hoffman, Red Dot, Thomas and Betts, Carlon or Steel City.

D. Non-metallic junction and pullboxes, fittings: Scepter or equal.

E. Fire Stops: General Electric Pensil 851 silicone foam, T & B Flame Safe, Dow Corning silicon RTV foam, 3M Fire Barrier, W.R. Grace Polycel 100, Chase Foam CTC PR-855, or STI Spec-Seal.

F. Water Stop Seals: O-Z/Gedney “WSK or CSM” and O-Z/Gedney “CSB” or equal conduit sealing bushings.


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**2.02 MATERIAL**

A. Conduit
1. Rigid steel: Fed. Spec. WW-C-581.
2. Rigid intermediate steel conduit, IMC: UL 1241 and Fed. Spec. WW-C-58l.
3. Electrical metallic tubing (EMT): Fed. Spec. WW-C-563. It shall not be used with cable rated above 600 volts.
4. Flexible steel conduit, commercial greenfield: Fed. Spec. A-A-55810 Type 4.
5. Liquid-tight flexible metal conduit: Shall consist of flexible galvanized steel tubing over which is extruded a liquid-tight jacket of polyvinyl chloride (PVC). Conduit shall be provided with a continuous copper bonding conductor wound spirally between the convolutions.
6. Direct burial plastic conduit: Fed. Spec. W-C-1094, type II or type III. Conduit shall be l Schedule 40 PVC or high density PE. Utilize low Volatile Organic Compound (V.O.C.) internally and external of building.
7. Surface metal raceway: Fed. Spec. W-C-582.

B. Conduit Fittings
1. Rigid steel and IMC conduit fittings:
   a. Fittings shall be standard threaded couplings, locknuts, bushings, and elbows. Fed. Spec. W-F-408 shall apply, except material shall be steel only. IMC couplings may be integral retractable type.
   b. Locknuts shall be of the conduit type with sharp edges for digging into the metal wall of an enclosure.
   c. Bushings shall be of the non-metallic or metallic insulating type and consist of an insulating insert molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   d. Erickson-type and set-screw couplings may be used to complete a conduit run where conduit is installed in concrete. Set screw fittings shall be approved for concrete installation and be case hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground.
   e. Sealing fittings shall be of the threaded cast iron type. Sealing fittings used to prevent passage of water vapor shall be of the continuous drain type. In concealed work, each fitting shall be installed in a flush steel box with blank coverplate having the same finish as that of other electrical plates in the room.
2. Electrical metallic tubing fittings:
   a. Fed. Spec. W-F-408 shall apply, except material shall be steel only.
   b. Couplings and connectors shall be set screw type with two screws each. Couplings for conduit sizes 2-1/2 inch and larger shall be set screw type with four screws each. Set screws shall be case-hardened steel with hex head and cup point to firmly seat in wall of conduit for positive ground. Provide gland and ring compression type in damp locations.
   c. Indent type connectors are not permitted.
   d. Die-cast or pressure-cast zinc-alloy fittings or fittings made of pot metal are not permitted.
3. Flexible steel conduit, greenfield, fittings:
   a. Fed. Spec. W-F-406 shall apply, except material shall be steel only.
   b. Shall be multiple point type, threading into the internal wall of the conduit convolutions or set screw type.
4. Liquid-tight flexible metal conduit fittings:
   a. Fed. Spec. W-F-406 shall apply, except material shall be steel only.


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b. Shall be of a type incorporating a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

5. Direct burial plastic conduit fittings: As recommended by the conduit manufacturer.
6. Expansion and deflection couplings:
   a. UL 467 and UL 514 shall apply.
   b. Shall accommodate, 1.9 cm (0.75 inch) deflection, expansion, or contraction in any direction, and shall allow 30 degree angular deflections.
   c. Shall include internal flexible metal braid sized to guarantee conduit ground continuity and fault currents in accordance with UL 467, and the NEC code tables for ground conductors.
   d. Shall be watertight, corrosion-resistant, threaded for and compatible with rigid or intermediate metal conduit.
   e. Jacket shall be flexible, corrosion-resistant, watertight, moisture and heat resistant molded rubber material with stainless steel jacket clamps.

C. Conduit Supports
1. All parts and hardware shall be zinc-coated or have equivalent corrosion protection.
2. Pipe Straps: Fed. Spec. FF-S-760, type 1, Style A or B.
3. Individual Conduit Hangers: Shall be designed for the purpose, and have pre-assembled closure bolts and nut and provisions for receiving hanger rod.
4. Multiple conduit trapeze hangers shall be not less than 1-1/2 by 1-1/2 inch, 12 gage steel, cold formed, lipped channels. Hanger rods shall be not less than 3/8-inch diameter steel.
5. Solid Masonry and Concrete Anchors: Fed. Spec. FF-S-325. Anchors shall be self-drilling expansion shields, or machine bolt expansion anchors.
6. Where hangers or supports are attached to beams, trusses or other structural supports, the attachments shall be fireproofed equal to supporting members.

D. Surface Metal Raceways
1. Surface metal raceways installed for branch circuits and signal conductors shall be one-piece and shall consist of base and cover section, zinc plated or galvanized steel with baked enamel finish, with full complement of fittings, boxes, adapters to conduit, transitions, etc. Raceway and components shall comply with U.L.-5 and shall be designed to accommodate pulling conductors through the raceway.

E. Outlet, Junction and Pull Boxes
1. Shall meet UL-50, UL-514 and Fed. Spec. W-J-800.
2. Outlet boxes shall be at least 1-1/2 inches deep, galvanized code gauge steel.
   a. For ceiling outlets, boxes shall be 4 inch octagonal, unless specified or required otherwise. Provide 3/8 inch fixture stud for attachment of lighting fixtures where required.
   b. For wall outlets in stud walls, boxes shall be 4 inch square with plaster ring, with number of gangs for devices shown.
   c. For wall outlets in masonry, tile or concrete surfaces, boxes shall be 4 inch square with corner type extension rings, and with number of gangs for devices shown.
   d. For poured concrete construction, boxes shall be concrete tight, and UL listed for concrete installation.
   e. For surface exposed wall or ceiling outlets, boxes in unfinished areas and equipment rooms shall be 4 inch square or multi-gang boxes with matching raised covers. Boxes in finished areas and where indicated shall be cast FS type with covers similar to those specified for finished plates.


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f. Cast boxes or fittings for vaportight or explosion-proof locations shall have suitable mounting lugs or feet cast integral with the fitting body.
g. For exterior or interior wet or damp locations, boxes shall be cast aluminum type with weatherproof cover.
h. For exposed surface metal raceway, such as Wiremold, Plugmold or one-piece raceways, boxes shall be special prefinished type to match raceway system, of gangs to accommodate devices shown, and with covers similar to those specified for finished plates. Verify finish (buff or ivory) with architect or interior designer.
i. Pull boxes shall be code gauge galvanized steel, of size required for proper conductor installation, with screwed covers.

F. Fire-Stop Material
1. Material shall be intumescent materials consisting of silicone foam sealant, caulk, putty or composite sheet materials, applied in accordance to manufacturer's instructions.
2. Seals for floor, exterior wall and roof shall also be watertight.

G. Sleeves
1. Provide sleeves for all cables passing through walls or floors.
2. Provide sleeves for all conduits passing through masonry and powered concrete walls. Powered concrete walls may be core drilled in lieu of cast-in-place sleeves.
3. Sleeves shall be consistent with fire barrier construction requirements.
4. Sleeves shall be new steel schedule 40 pipe or of greater strength.

H. Wireways: Wireways shall include hinged covers, except where removable covers are shown on drawings. Wireways shall be painted inside and outside with baked enamel finish.

## PART 3 EXECUTION

### 3.01 PENETRATIONS

A. Cutting of Holes:
1. Holes through concrete and masonry in new and existing structures shall be cut with a diamond bit core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills are not allowed, except where permitted by the Engineer as required by limited working space.
2. Holes shall be located so as not to affect structural sections such as ribs, beams or pre-stressed cables.
3. Holes shall be laid out in advance. The Structural Engineer shall be advised prior to drilling through structural sections, for determination of proper layout.
4. Core drilling of holes through post-tension slabs or beams shall not be made until all cables in the immediate vicinity have been located by visual, magnetic, x-ray or other non-destructive means. Core drilling shall be withheld a minimum of three inches from the cables to insure the cables are not broken or damaged due to the coring operation.
5. Shot-in anchors for securing steel studs, conduit hangers, etc. to post-tension slabs or beams shall have a maximum of one-half inch penetration into the slab at areas where cables approach either the top or bottom surfaces of the slabs or beams.

B. Fire-Stops
1. Where conduits, wireways and other electrical raceways pass through fire partitions, fire walls, or floors, install a fire-stop that provides an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight and completely fill clearances between raceways and couplings.


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2. Floor, exterior wall and roof seals shall also be made watertight.
3. Where conduits pierce the roof, refer to architectural specifications and drawings for detail.

C. Waterproof Penetration
1. When conduits pass thru waterproofed building roofs, foundation walls or floors, install waterproof sleeves with waterproofing materials compatible with the waterproofing system installed on the respective surface being penetrated.
2. All sleeves through exterior building walls shall prevent water migration and shall be double sealed on the inside and outside of the wall with sealing bushings and stainless steel hardware. Service entrance feeders shall have an additional sealing bushing installed on the inside of conduit to waterproof seal the entrance cable.

D. Sleeves
1. Provide sleeves for all conduits, raceways, cables, ducts or pipes that pass thru walls, concrete slabs, concrete columns or concrete bridging. Provide sleeves whether or not specifically indicated.
2. Provide sleeves passing thru walls, slabs, beams, bridging, or columns, which are 1/2 to 1 inch greater in inside diameter than external diameter of the electrical materials passing through the sleeves. Provide for conduits of diameters 2 inches in diameter or greater.
3. Sleeves through walls shall extend full thickness of wall, cut flush with finished surface.
4. At sleeves through exterior building walls, provide water stop seals between sleeves and or masonry wall material or electrical materials (cables or conduits) passing through sleeves.
5. Permanent sleeves through floor slabs shall extend two inches above finished floor. In mechanical equipment rooms or rooms containing liquid, sleeves shall extend two inches above the floor. Provide concrete curb around group of conduits, raceways, cables, etc. to provide a four inch high watertight barrier at the floor.

**3.02 CONDUIT INSTALLATION, GENERAL**

A. Installation shall be in accordance with UL, NEC and as hereinafter specified unless shown otherwise on the drawings. Do not install conduit in stairwells, elevator shafts, or elevator equipment rooms unless conduit is feeding equipment and devices for these rooms or areas. Conduit shall be installed concealed in finished spaces. Where conduit is installed exposed those areas shall be reviewed with the owner and architect prior to installation and as then installed as otherwise directed in these specifications.

B. Size: Minimum size of conduit shall be 1/2-inch. Size shall be in accordance with the NEC, but not less than shown on the drawings. Branch circuit homeruns shall be minimum 3/4 inch size. Branch circuit homeruns shall be defined as the conduit from the panelboard to the first outlet device. This does not apply to motor branch circuits.

C. Conduit installation shall be as follows:
1. Installed as complete runs before pulling in cables or wires.
2. Flattened, dented or deformed conduit is not permitted and shall be removed and replaced.
3. Installed so they will not obstruct head room, walkways or doorways.
4. Cut square with a hacksaw, reamed, burrs removed and drawn up tight.
5. Mechanically and electrically continuous.
6. Supported within one foot of all changes of direction and within one foot of each enclosure to which connected.


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7. End of empty conduit to be closed with plugs or caps at rough-in stage to prevent entry of debris until wires are pulled in.
8. Tightening set screws with pliers will not be permitted.
9. Conduits shall be secured to cabinets, junction boxes, pull boxes and outlet boxes by bonding type locknuts. Rigid and IMC conduit installations shall have a locknut on the outside and locknut and bushing on the inside of the enclosure. EMT installations may have a single locknut on the inside of the enclosure, made up wrench tight. Conduit connections shall not be made to junction box covers.
10. Install a pull wire in all empty conduits consisting of one #12 steel or copper wire or heavy duty nylon cord for small conduits and nylon rope for large conduits.
11. Aluminum conduit shall not be used.
12. Seal conduit at all building entrances to exterior equipment such as building mounted lighting, receptacle, and roof top units with suitable compound to prevent the infiltration of moisture and gasses.

D. Conduit Bends:
1. Shall be made with standard conduit bending machines.
2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
3. Conduits shall not be bent with a pipe tee or vise.

E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, substantially as shown on the drawings.
2. Deviations shall be made only where necessary to avoid interferences and as approved by the Engineer.
3. Where conduit is not shown, provide conduit complying with the N.E.C. per electrical contractor discretion and field conditions. Provide maximum of 3 circuits per homerun, unless otherwise noted on the drawings.

**3.03 CONCEALED WORK INSTALLATION**

A. In Concrete:
1. Conduit shall be rigid steel, IMC, or EMT. PVC shall be used only where specifically noted. EMT shall not be installed in concrete slabs that are in contact with soil, gravel or vapor barriers.
2. Conduit shall be run in direct lines.
3. Conduit shall not be installed through concrete beams, except:
   a. Where shown on the structural drawings.
   b. As approved by the Structural Engineer prior to construction.
4. Conduit shall not be installed in concrete which is less than three inches thick, except 2" in topping concrete.
   a. Conduit outside diameter larger than 1/3 of the slab thickness is not permitted.
   b. Spacing between conduits in slab shall be approximately six conduit diameters apart except one conduit diameter at conduit crossings.
   c. Conduits shall be installed approximately at the center of the slab so that there will be a minimum of 3/4-inch of concrete around them.
5. Couplings and connections shall be watertight. Thread compounds shall be UL approved conductive type to insure low resistance ground continuity through the conduits.

B. Above Furred or Suspended Ceilings and in Walls
1. 600 Volts and Below
   a. Conduit shall be rigid steel, IMC, or EMT. Types shall not be mixed indiscriminately in the same system.


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2. Branch circuit conduits, and conduits feeding ceiling lighting shall not be supported by the suspended ceiling lighting fixtures, mechanical piping, or air conditioning ducts. Branch circuit conduits serving equipment mounted above or in the ceiling system only, may be fastened to the ceiling support members. All other raceway systems and components shall be independently supported from the structure.
3. Recessed lighting fixtures shall be connected to conduit runs with not over six feet of 1/2" flexible metal conduit extending from a junction box to the fixture.

**3.04 EXPOSED WORK INSTALLATION**

A. 600 Volts and Below
   1. Conduit shall be rigid steel, IMC, or EMT. Types shall not be mixed indiscriminately in the same system.

B. Conduit shall be run parallel or perpendicular to the building lines.

C. Horizontal runs shall be installed close to the ceiling or beams and secured with approved conduit straps.

D. Horizontal or vertical runs shall be supported at not over eight foot intervals.

E. Surface Metal Raceways:
   1. Surface metal raceways shall be used only where shown on the drawings and shall be installed parallel and perpendicular to the building lines, complete with fasteners, fittings and extensions as required for a complete raceway system. Raceway shall be sized to accommodate number of conductors indicated or required.

**3.05 BELOW GRADE INSTALLATION**

A. 600 Volts and Less.
   1. Conduit shall be PVC or high density PE, unless otherwise shown on the drawings or specifications.
      a. Provide Schedule 40 (minimum) below non-paved areas and schedule 80 below paved areas.
      b. Conduit sweeps or extensions out of the ground or above the floor slab and risers shall be Schedule 80 or PVC coated rigid steel conduit if concealed and only galvanized rigid steel conduit if exposed.
      c. 90 degree bends underground shall be Schedule 80 PVC or PVC coated rigid steel conduit.
   2. Conduit shall be marked at uniform intervals to indicate the kind of material, direct burial type and the UL approved label.
   3. Proper conduit fittings and terminations shall be installed as recommended by the conduit manufacturer.
   4. Tops of conduit shall be:
      a. Not less than 24 inches and not less than shown on the drawings below finished grade.
      b. Not less than 30 inches and not less than shown on the drawings below road and other paved surfaces.
   5. Work with extreme care near existing ducts, conduits, cables, and other utilities to avoid damaging them.
   6. Cut the trenches neatly and uniformly.
   7. Do not kink the conduits.


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8. Seal conduits, including spare conduits at building entrances and at outdoor terminations for equipment with a suitable compound to prevent the entrance of moisture and gases.
9. Where metal conduit is shown on drawings, install threaded heavy wall rigid steel galvanized conduit or type A20 rigid steel galvanized conduit coated with 20 mil bonded PVC, or rigid steel or IMC, PVC coated or standard coated with bituminous asphaltic compound.

## 3.06 WET OR DAMP LOCATIONS

A. Unless otherwise shown on drawings, conduits shall be rigid steel, IMC, or Liquid-tight flexible metal conduit. PVC may be used where specifically indicated on drawings.

B. Provide sealing fittings, to prevent passage of water vapor, where conduits pass from warm to cold locations, such as refrigerated spaces, constant temperature rooms, air conditioned spaces or similar spaces.

C. Unless otherwise shown on the drawings, conduit below concrete slabs in contact with soil, gravel, or vapor barriers shall be PVC rigid steel or IMC. Metallic conduit shall have a factory coating of 20 mil bonded PVC or shall be field coated on the outside with asphaltum before installation. Couplings and damaged areas of coating shall be completely coated after installation. If PVC is installed, all elbows and all stub-ups through slab shall be PVC coated rigid steel or IMC.

D. For poles, all mounting hardware shall be stainless steel and conduit galvanized IMC unless otherwise noted.

## 3.07 MOTORS AND VIBRATING EQUIPMENT

A. Flexible metal conduit or Greenfield shall be used for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission. Provide separate insulated copper ground wire within the conduit. Use liquid-tight flexible metal conduit for all pump motor connections and areas where exposure to wet conditions is possible.

## 3.08 EXPANSION JOINTS

A. Conduits 3 inches and larger, rigidly secured to building construction on opposite sides of a building expansion joint, shall be provided with expansion and deflection couplings. The couplings shall be installed in accordance with the manufacturer's recommendations.

B. Conduits smaller than 3 inches shall be provided with junction boxes on both sides of the expansion joint, and connected by 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above may be installed.

C. Expansion and deflection couplings shall also be installed where shown on the drawings.

D. Seismic Areas: In seismic areas, conduits rigidly secured to building construction on opposite sides of a building expansion joint shall be provided with junction boxes on both sides of the joint and connected by 15 inches of slack flexible conduit. Flexible conduit shall have a copper green ground bonding jumper installed.


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**3.09 CONDUIT SUPPORTS, INSTALLATION**

A. Safe working load shall not exceed 1/4 of proof test load of fastening devices.

B. Pipe straps or individual conduit hangers shall be used for supporting individual conduits.

C. Multiple conduit runs shall be supported by trapeze hangers. Trapeze hanger shall be designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 pounds. Each conduit shall be attached by U-bolt or other approved fastener.

D. Conduit shall be supported independently of junction boxes, pull boxes, fixtures, suspended ceiling T-bars, angle supports, etc., except as specifically approved by the Engineer.

E. Solid Masonry and Concrete: Fasteners shall be as follows:
   1. New Construction: Generally, steel or malleable iron concrete inserts in concrete prior to pouring.
   2. Already In-place Construction:
      a. Steel expansion anchors not less than 1/4-inch bolt size and not less than 1-1/8 inch embedment.
      b. Power set fasteners shall be approved, and not less than 1/4-inch diameter with depth of penetration not less than three inches.
      c. Anchors or fasteners attached to concrete ceilings shall be vibration and shock resistant.

F. Hollow Masonry: Toggle bolts are permitted. Bolts supported only by plaster are not acceptable.

G. Metal Structures: Fasteners shall be machine screw or devices specifically designed and approved for the application.

H. Attachments by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking is not permitted.

I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

J. Spring steel type supports or fasteners shall be permitted for concealed 1/2" EMT only serving equipment mounted above or in the ceiling system only.

K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown on the drawings. Supports for cable and wire shall have fittings which include internal wedges and retaining collars.

**3.10 BOX INSTALLATION**

A. Boxes for concealed conduits shall be flush mounted, set plumb, level and true with surrounding materials and shall be set back no more than 1/8 inch from the finished surface. Both sides of boxes shall be secured.

B. Boxes for exposed conduits and metal raceways shall be mounted plumb, level and true with surrounding materials and shall have no projecting edges or corners.


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C. Covers shall be provided for all boxes and shall be of a design to fit the particular box and location. Covers shall be aligned with the walls and finishes. Where these covers are to receive a finish coat of paint, this contractor shall furnish covers with one coat of primer. In finished spaces, covers shall be similar to those specified under finished plates.

D. Standard 4-11/16 inch square boxes shall be used for outlets where required for additional wire and connector space.

E. Pull boxes and junction boxes are generally not indicated on drawings except for special requirements. This contractor shall install pull and junction boxes as required to facilitate wire pulling. Pull and junction boxes shall be installed in accessible locations and shall not be installed in finished spaces without prior approval of the Engineer. Pull boxes shall be permanently labeled to identify the system and wiring within.

F. Remove only knockouts required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

G. Outlet boxes in the same fire-resistive wall or fire-resistive partition shall not be mounted back-to-back but shall be separated by a horizontal distance of 24 inches minimum. Where outlet location requirements require back-to-back installation a firestopping method approved by the local authority shall be utilized.

H. Outlet boxes in the same sound insulated wall shall not be mounted back-to-back but shall be separated by a horizontal distance of 24 inches minimum.

**END OF SECTION**


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**SECTION 260553**

**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

## PART 1 GENERAL

### 1.01 SCOPE

A. Work included in this section includes the identification of electrical equipment as specified and indicated on the drawings.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260533 - Raceway and Boxes for Electrical Systems

C. Section 262413 - Switchboards

D. Section 242416 - Panelboards

E. Section 262419 - Motor Control Centers

F. Section 262812 - Enclosed Switches and Circuit Breakers

G. Section 262913 - Enclosed Controllers

H. Section 264300 - Surge Protective Device (SPD)

### 1.03 IDENTIFICATION

A. Provide identification devices for electrical systems and equipment as follows:
   1. Provide typewritten card directory describing circuits in each panelboard.
   2. For switch and protective equipment in the power distribution equipment, relay cabinets, panelboards, terminal cabinets, motor control stations, motor starting equipment, individually and motor control center mounted, provide engraved black laminated plastic plates with white lettering. Attach plates with self-tapping screws or adhesive.
   3. For motors, communications and signal systems pull and/or junction boxes, provide orange flexible plastic tapes, Dymo Industries, Inc., or equal.
   4. Identification nameplates shall be in accordance with the following examples:

| Device Typical | Legend |
|---|---|
| Secondary Switchboards | Panelboard, LV101, MCC#1,etc. |
| Panelboards, Lighting Control Panel* | HV101, LV101, ELV101, etc. |
| Motor Starters | M1; Gen. Supply Fan S1, etc. |
| Terminal Cabinets | PA1, TEL1, N/C1, FA1, etc. |
| Comm & Signal Systems** | PA, TEL, N/C, FA, etc. |
| Pull or Junction Boxes** | Panel LV101, Feeder, etc. |
| Time Clocks | East Park Lot, etc. |


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| Device Legend | Location |
|---|---|
| Secondary Switchboards | Device Cover |
| Panelboards, Lighting Control Panel | Hinged Door |
| Motor Starters | Starter Cover |
| Terminal Cabinets | Inside Surface, Hinged Door |
| Motors | Motor case near nameplate |
| Comm, Alarm & Signal Junction Boxes | Box Cover |

*Locate designation on outside surface of panel door in equipment rooms, e.g., electrical closets, mechanical/electrical equipment rooms. Locate designation on inside surface of panel door in finished and occupied rooms.

**Where the boxes are located above suspended ceilings or exposed in unfinished areas, the designation shall be on the front or outside of the cover; and where located in finished spaces, the identification shall be on the inside of the cover.

5. Where conductors of two or more feeder circuits are present in any one pull box or junction box, the conductors shall be identified with tags firmly affixed to the conductors. The tags shall be of fiber or bakelite, at least 1/16" in thickness and 3/4" in diameter, with stamped or engraved characters 3/32" high to indicate the circuit designation.
6. All feeder terminations shall be identified as to phase for each conductor using tags described in Paragraph 3 above or may be identified with colored paint or colored electrician's tape.
7. Where the engraving of wiring device plates is called for on the drawings, the plates shall be machine engraved and the letters filled with black enamel. Characters shall be at least 3/16" high.
8. In each handhole install metal tags on each circuit cable and wires to clearly designate their circuit identification and voltage. Tags shall be embossed brass type. Attach tape with slip-free plastic lacing units.

**END OF SECTION**


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**SECTION 260926**

**LIGHTING CONTROL SYSTEM**

## PART 1 GENERAL

### 1.01 SCOPE

A. This section includes the furnishing installation and connections for a lighting control system as indicated on the drawings and as described herein. It is the intent of this section to provide an integrated, energy saving lighting control system including Lighting Control Panels, Lighting Control Devices, Occupancy Sensors, and Daylight Sensor Controls from a single supplier. Contractor is responsible for confirming that the panels, control devices and sensors interoperate as a single system.

B. This section specifies a system or part of a system being commissioned as defined in Division 1 General Commissioning Requirements. Testing of these systems, as well as Training of the Owner's personnel, is required in cooperation with the Owner's Representative and the Commissioning Professional. Project Closeout is dependent on successful completion of all commissioning procedures, documentation and issue closure.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260533 - Raceway and Boxes for Electrical System

C. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below)

D. Section 262726 – Wiring Devices

E. Section 265100 - Lighting

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit catalog cuts for lighting control panels(s) and control devices including wiring diagrams prepared specifically for this project.
   3. Submit floor plans showing lighting control panels, controllers, control switches, occupancy and daylighting sensor locations.

B. Pre-installation coordination meeting notes with the lighting control vendor.

C. Pre-installation coordination meeting notes with the building automation system contractor.

D. Pre-installation programming review coordination meeting notes with the Owner.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS


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A. Watt Stopper, Sensor Switch, L C & D, Douglas, Leviton, Hubbell or pre-bid approved equal.

B. With both a factory representation and supplying distributor in the local project area.

**2.02 LIGHTING CONTROL RELAY PANEL**

A. Panel Hardware. Provide fully assembled and tested panel(s) as indicated on the drawings. Panel shall contain relays as required by circuiting with 2 spares. Each panel shall contain:
   1. Enclosure
      a. A code gauge sheet metal enclosure shall house all electronic parts.
      b. Provide a surface or recessed trim as indicated on the drawings. Provide the trim with a hinged, lockable door that accesses the Class 2 circuitry and relays only.
      c. Provide the trim primed and painted with a manufacturer's standard color.
      d. Integral barriers shall separate the line voltage area from Class 2 circuitry and 120 volt and 277 volt circuits.
   2. Power Supply
      a. The incoming line power shall connect to a single dual-rated 120/277 VAC, 60 Hz, +10, -15% power supply transformer.
      b. A secondary fuse and/or inherent impedance limitation shall protect the Class 2 circuitry.
      c. Provide a dedicated circuit to power lighting control panel. Obtain circuit from nearest lighting panel.
   3. Relays
      a. Each controlled circuit shall be connected through a single pole, single throw latching relay, which requires no energy use to hold the contacts in position. With loss of control power, relays are either to default to the normal position or to be able to be individually manually controlled ON/OFF without the use of control power.
      b. The relay shall contain a solenoid coil that toggles the contacts to the opposite position with each operation.
      c. The main power contacts shall be rated for 30A for 277 VAC Ballast and HID lighting loads.
      d. Relays shall accept a #10-#14 AWG wires.
      e. Provide two-pole relays for 208 or 480V loads.
      f. Each relay shall be individually replaceable without replacement of multiple relays.
      g. Relays used to control code required emergency egress lighting circuits, to be UL924 listed and be separated from the balance of the relays by a protective barrier. Relays are to be defaulted to the ON position upon loss of control power **[or upon activation of the fire alarm system]**.
      h. Relays using zero crossing technology are not allowed.
      i. Relays shall have a UL listing for a minimum short circuit current rating (SCCR) of 14,000 amps.

B. Control Capabilities
   1. Override Switches
      a. System shall be capable of flashing lights ON/OFF for any relay or any zone prior to lights being turned OFF. The warning interval time between the flash and the final lights OFF shall be definable for each zone. Occupant shall be able to override any scheduled OFF sweep using a local wall switch within the occupied space.
   2. Master Switch
      a. The controller shall contain all-on and all-off inputs. Operation of these inputs with a switch will turn all loads on and off.


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3. Time Switch
   a. A time switch module shall be provided.
   b. The timer shall be adjustable for automatic daylight savings time, and leap year settings.
4. Overrides
   a. Switch inputs shall turn off or back on the relay when activated during a programmed time schedule.
   b. When selected, a two hour override timer shall be activated when a switch input is pushed during the occupant warning period to provide two additional hours of operation.
   c. If the time schedule is not active, operating a switch input will provide a two hour on period.

C. Communications
1. Each panel shall be capable of stand-alone automatic operation.
2. Each panel shall also be connected together with a communications network to allow loads from one panel to be controlled from inputs from another panel.
3. Operator's Software
   a. Provide web based operator's software for user's monitoring or programming.
   b. Software to monitor/control all relays. Software shall show actual relay states, with an optional menu showing how and when the relay state occurred, and when next scheduled to change.
   c. The software shall include trends and relay runtime analysis that will allow the operator to analyze the operation of specific areas and identify those exceeding normal runtimes. Individual relays may be assigned a kWh weighted value or simply analyzed on a runtime basis. In both cases, the relays may be assigned to logical groups and plotted for the last 30 days or 12 months.
   d. Provide network cabling from the lighting control panel to the owner's network. Coordinate with the owner for the location of the nearest network jack or rack in a communications closet.
   e. Coordinate with the network system installer or IT staff to assign the lighting control system a network address and to properly program and recognize the lighting control system node on the network.

3. Provide Building Automation System (BAS) interface.
   a. Provide cabling and interface to the BAS system. Coordinate with the controls contractor or the Owner for the system interface type.
   b. Provide the communications protocol to allow scheduling, monitor status, and override lighting from the BAS system.
   c. Provide the Owner's controls contractor the events and control scheduling interface for their use in modifying the BAS for interface.

**2.03 OCCUPANCY SENSORS**

A. Sensors shall be provided with a field selectable option to convert sensor operation from automatic-ON/OFF to manual-ON automatic -OFF. Sensors that are used along with switching are to be set for manual-ON automatic –OFF (Vacancy Mode). Sensors that are not used with switching are to be set to operate as automatic-ON/OFF or as indicated on the drawings or programming schedule.

B. Passive infrared sensors shall provide high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line).


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C. Dual technology sensors shall consist of passive infrared and ultrasonic or noise detection technologies for occupancy detection. Upon activation, detection by either technology shall hold lighting ON.

D. Ultrasonic sensors shall utilize advanced signal processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

E. Ultrasonic operating frequency shall be crystal controlled at 40 kHz ± 0.002% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

F. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, LED drivers and rated motor loads.

G. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

H. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering. Sensors only using “smart adaptive” technology to automatically adjust time delay and sensitivity settings are not allowed.

I. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

J. Where specified, sensors shall offer daylighting foot-candle adjustment control and be able to accommodate dual level lighting.

K. Sensor shall have a time delay adjustable from 30 seconds to 30 minutes. Set initially to turn lights OFF after 20 minutes.

L. Automatic line voltage wall sensor switch shall have the following features:
   1. Shall be a dual technology sensor and shall be a 3 wire, self-contained control system that replaces a standard toggle switch. Sensor shall have ground wire for safety. Switching mechanism shall be latching air gap relay, compatible with electronic ballasts, compact fluorescent and inductive loads.
   2. Sensor shall operate at either 120 VAC or 277 VAC.
   3. Sensor shall have no minimum load requirement and shall be capable of switching 0 to 800 watt ballast or tungsten or 1/6 hp @ 120 volts, 60 Hz; 0 to 1200 watts for ballast or 1/3 hp @ 277 volts, 60 Hz.
   4. Where specified, sensor shall have a built-in light level feature adjustable from 2 to 200 footcandles that holds lighting OFF when a desired footcandle level is present.
   5. For safety, sensor shall have 100% off switch with no leakage current to load in OFF mode.
   6. For safety, in the event there is an open circuit in the AC line such as a ballast or lamp failure, the sensor shall automatically switch to OFF mode.
   7. Where specified, sensor shall utilize two relays, with dual switch controls for dual level lighting control. Relays shall be capable of simultaneously controlling independent lighting loads or circuits. The second relay shall be isolated, allowing for two-circuit control of area lights. If sensor is equipped with a light level sensor, only the second relay is controlled by the sensor for day light control.


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M. Automatic low profile flush mounted ceiling or surface wall mounted sensor(s) shall have the following features:
   1. Shall be dual technology.
   2. Sensor shall operate at either 24 VDC OR 24 VAC and use a power pack or operate at line voltage at either 120 VAC or 277 VAC and shall not require a power pack. Coordinate voltage type with light fixture schedule and balance of room controls.
   3. Where specified, sensors shall have a built-in light level sensor that works from 10 to 300 foot-candles.
   4. Sensors shall have a “manual ON/OFF” function that is controlled by installing local wall control(s). Were drawings indicate local wall control(s), provide low voltage control(s) for the control function.
   5. For high ceiling applications, provide an extended coverage sensor.
   6. For low temperature or high humidity applications, provide a sensor rated for application.
   7. For each area controlled by sensors, provide an isolated relay module or contact on sensor with normally open and closed contacts for use by HVAC control. Coordinate quantity, location and final control connection requirements with Sequence of Operations specification section 230993 and with the building automation system (BAS) contractor.
   8. Refer to drawings for either flush or surface mounted configuration of devices.

**2.04 DAYLIGHTING SENSORS**

A. The sensor shall be a self-contained control device that detects changes in light levels. The sensor shall adjust the light levels by raising or lowering the light level, by controlling fixture 0 to 10 volt dimming ballast or controlling a 50% to 100% stepped level dimming ballast or provide ON/OFF switching of the fixture circuit with either a power pack or relay in the control panel. Coordinate with light fixture and lighting control schedules as to type of control to be provided.

B. The sensor shall be either a closed loop device that measures both the daylight contribution and the controlled electric light contribution or an open loop device that measures just the daylight contribution. Type of device will be determined by the application.

C. The sensor shall be a low voltage device, powered by 24 VDC or 24 VAC voltage supplied by a power pack.

D. The sensor shall have a linear response with greater than 1% accuracy over the sensed range.

E. The sensor shall have a control range of 10-100 foot-candles.

F. To ensure quality and reliability, sensor shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

G. Sensor styles for indoor and skylight/atrium installations to be ceiling mounted or as required and as shown on drawings. Verify sensor mounting location(s) with Architect prior to installation.

H. Outdoor sensors shall be weatherproof and located as shown on drawings. Exterior lights shall be controlled by a combination sensor and time clock. The photosensor shall provide the ON function at dusk and the time clock shall control specific circuit(s) OFF functions during dark hours.

I. Provide dual zone sensors where indicated.


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## 2.05 LIGHTING CONTROL SWITCHES

A. Switching to be accomplished with specification grade low voltage switching devices. Where one or two devices are indicated, install single handle toggle devices in a ganged cover plate. Where more than two devices are indicated, install multiple push button or rocker control devices in a single-gang cover plate or as indicated on the drawings. See wiring device specification section for device color and for type of cover plate.

## 2.06 LIGHTING CONTROL DIMMERS

A. Dimming to be accomplished with a 0 to 10 volt device. Multiple devices to be installed in a ganged cover plate. See wiring device specification section for device color and for type of cover plate.

## 2.07 EMERGENCY LIGHTING CONTROL RELAY

A. Provide emergency lighting control relays where required to allow control of emergency lighting in conjunction with normal lighting. Relays to be U.L. 924 listed for switching between normal and emergency power to lights.

B. Normally-closed electrically-held relays to be wired in parallel with a wall control, occupancy sensor or lighting control panel. Controlled emergency lighting will be automatically shunted on during a power outage.

C. Locate relays in accessible ceiling space above doorway to room or area where lighting is being controlled.

D. Provide wiring diagrams indicating interconnections between relay and lighting controls.

E. Provide two spare relays for the Owner.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Refer to the room lighting control schedule and lighting control panel schedule for relay quantities, zone assignments, and initial programming criteria.

B. Installation shall be in accordance with NEC, manufacturer’s written instructions, and as shown on the drawings.

C. Verify all voltage requirements before ordering material to assure proper operation with the electrical system. Provide single or two-pole relays as required by local types.

D. Provide control wiring between lighting control devices and lighting control panels. Size and wire type shall be as per manufacturer’s requirements.

E. Install all lighting control wiring in conduit except when installed in an accessible ceiling spaces. Provide plenum rated cables when installed in ceiling plenum spaces. Comply with specification Section 260519 requirements for cable installation.

F. Occupancy sensor installation
   1. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of


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controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

2. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

G. Daylight sensor installation
   1. It shall be the contractor's responsibility to provide the correct technology, locate and aim sensors in the correct location required for complete and proper coverage of controlled areas per the manufacturer's recommendations. The locations of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
   2. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components.

H. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.

I. Individual room lighting control modules or cabinets to be installed in the rooms being controlled. Multiple rooms controlled from one control module or cabinet is not allowed. Control equipment to be located above the ceiling in an accessible location at the entry door inside of the room being controlled. In open office or core areas, install all lighting control modules or cabinets in the nearest electrical closet or as indicated on the drawings.

J. It is the contractor’s responsibility to arrange for a pre-installation meeting with the Owner, at the Owner's facility, to review and verify the operational programming for the lighting control system. This Contractor shall document their meeting and submit meeting notes for review and approval by the project Engineer and Owner.

K. It is the contractor’s responsibility to arrange for a pre-installation meeting with the Building Automation Systems (BAS) control contractor, to review and verify the operational programming for the lighting control system and interface to the BAS system. This Contractor shall document their meeting and submit meeting notes for review and approval by the project Engineer and Owner.

L. It is the contractor’s responsibility to arrange for a pre-installation meeting with the Owner, at the Owner's facility, to review and verify the operational programming for the lighting control system. This Contractor shall document their meeting and submit meeting notes for review and approval by the project Engineer and Owner.

M. It is the contractor’s responsibility to arrange for a pre-installation meeting with the lighting controls manufacturer's factory authorized representative, at the Owner's facility, to verify the placement of sensors, wiring and installation criteria for the lighting control system. This Contractor shall document their meeting and submit meeting notes for review and approval by the project Engineer and Owner.


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**3.02 SYSTEM START UP**

A. Manufacturer shall provide a factory authorized technician on site to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:
   1. That all occupancy and daylighting sensors are located, installed, and adjusted as intended by the factory and the contract documents.
   2. The occupancy sensors and daylighting sensors are operating within the manufacturers specifications.
   3. The sensors and relay panels interact as a complete and operational system to meet the
   4. Manufacturer to provide a written statement to the Engineer and owner verifying that the system meets the above requirements prior to Engineers final inspection.

**3.03 COMMISSIONING**

A. Contractor shall provide a factory authorized technician on site to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:

   1. Verify and document that applicable equipment and systems are installed according to the manufacturer's recommendations, contract requirements, and industry standards, and that they receive adequate operational checkout by installing contractor.
   2. Verify and document proper performance of equipment and systems.
   3. Verify and document that Operation & Maintenance documentation is complete.
   4. Verify and document that the facility operating personnel are properly trained.

**3.03 SYSTEM TRAINING AND PROGRAMMING**

A. Manufacturer shall provide factory authorized technician on site to program and train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls. The manufacturer is to provide Owner training for not less than two 4-hour periods. Video record one training session and provide the Owner a DVD for future review.

B. In addition to the initial programming and training, provide a follow up visit for not less than one 4-hour period within the next year after acceptance of the system by the Owner. Visit to include additional instruction and programming adjustments of the system as directed by the Owner.

**3.04 SYSTEM VERIFICATION**

A. In the presence of the Owner, Engineer, or their designated representative and the lighting control system equipment manufacturer, make a thorough inspection and test of the complete lighting control system.

**3.05 MANUALS**

A. Submit complete operating and maintenance manuals in the format required by Division 1 to include:
   1. "As installed" set of complete wiring diagrams and floor plans locating all of the devices.
   2. Information required to operate the equipment and system.
   3. Information for testing, repair, trouble shooting and recommended maintenance intervals.
   4. Provide a replacement parts list and name and address where available.


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B. “As installed” Bill of Materials to include catalog cuts of all components of the lighting control system.

**END OF SECTION**


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**SECTION 262413**

**SWITCHBOARDS**

## PART 1 GENERAL

### 1.01 SCOPE

A. This section includes the furnishing, installation and connection of the distribution switchboards.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below)

C. Section 260526 - Grounding and Bonding for Electrical Systems

D. Section 260553 - Identification for Electrical Systems

E. Section 261113 - Primary Unit Substations

F. Section 262500 - Enclosed Busway Assemblies

### 1.03 FACTORY TESTS

A. Design tests shall have been performed on a type or style of switchboard similar to that being furnished for this project. Perform production tests of dielectric, mechanical operation, grounding of instrument transformer cases, electrical operation and control wiring and ground fault sensing equipment tests on the switchboards provided for this project. Tests shall be in accordance with NEMA PB 2 and UL-891.

### 1.04 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Sufficient information, clearly presented shall be included to determine compliance with drawings and specifications.
   3. Include electrical ratings, dimensions, material, required clearances, terminations, weight, plan, front, side and rear elevations, buswork, fused switch frame and rating (circuit breaker), accessories and device nameplate data.
   4. Show the size, ampere rating, number of bars per phase and neutral in each bus run, horizontal and vertical, bus spacing, equipment ground bus and bus material.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Switchboards and accessories: Cutler-Hammer (Eaton), General Electric, Siemens-ITE, Square D.

B. Bolted pressure switches: Bolt-Loc, Boltswitch, Pringle.


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**2.02 GENERAL**

A. Switchboards shall be in accordance with UL, NEMA, NEC, ANSI and as shown on the drawings.

B. Switchboards shall be provided complete ready for operation including, but not limited to housing, buses, fused switches (circuit breakers), (instruments and related transformers, fuses and wiring).

C. Switchboard dimensions shall not exceed the space provided as shown on the drawings.

**2.03 BASIC ARRANGEMENT**

A. Switchboard shall be front accessible with the following features:
   1. Device mounting:
      a. Main switch individually mounted and compartmented.
      b. Feeder switches panel mounted.
   2. Full height wiring gutter covers for access to wiring terminals.
   3. Bus bracing: 70,000 amperes rms symmetrical.
   4. Barriers shall be provided in service switchboard to isolate the service bus bars and terminals from the remainder of the switchboard.
   5. Provide space for utility company KWH, demand and KVAR meters and fully bused current transformer compartment for bolt-on type current transformers.

**2.04 HOUSING**

A. Provide a completely enclosed, free standing, steel enclosure not less than the gauge required by the standards. The enclosure is to consist of the required number of vertical sections bolted together to form one metal enclosed rigid switchboard. The sides, top and rear shall be covered with removable screw on sheet steel plates.

B. Provide ventilating louvers where required to limit the temperature rise of current carrying parts and to provide for 100% duty rating of bolted pressure switches where necessary. All openings shall be protected against entrance of falling dirt, water or foreign matter.

C. Group the instrument meters and their control switches on a hinged front cover. Provide concealed hinges and latch.

D. Thoroughly clean, phosphate treat and prime all steel with rust-inhibiting paint. Final finish coat to be the manufacturer's standard gray or blue.

**2.05 BUSES**

A. Buses shall be arranged for 3-phase, 4-wire distribution. Full size main phase buses and full size neutral bus shall be installed the entire length of the switchboard. Provide for future extensions by means of bolt holes or other approved method.

B. Buses and connections shall be copper of 98 percent conductivity or high strength tin plated aluminum.

C. All contact surfaces shall be plated. Provide a minimum of two plated bolts per splice. Where physical bus size permits only one bolt, provide a means other than friction to prevent turning,


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twisting or bending. Make connections with plated nuts and bolts with a flat plated steel washer against the bus and a bellville washer between the flat washer and nut. Torque bolts to the manufacturer's recommended values.

D. Provide bare neutral bus and mount on insulated bus supports. Provide neutral disconnect link to permit isolation of neutral bus from the common ground bus and service entrance conductors.

E. Where "provision for", "future", or "space" as noted on drawings, the space shall be equipped with bus connections to the future overcurrent device. Provide buses for the ampere rating as shown for the future device. Spacing shall be grouped continuously in switchboard so that new devices can be added without relocating existing devices.

F. Provide an uninsulated 1/4-inch by 2-inch copper equipment ground bus bar the length of the switchboard and secure at each section.

G. Connect an uninsulated 1/4-inch by 2-inch copper bus between the neutral and ground buses to establish the system common ground point.

## 2.06 NAMEPLATES

A. Provide laminated black phenolic resin with white core with 3/16-inch high engraved lettered nameplates for each switch to indicate the feeder, panelboards and equipment served, mounted with plated screws.

## 2.07 SURGE PROTECTIVE DEVICE (SPD)

A. Provide SPD protection; see specification section 264300 for requirements. Unit shall be installed by the switchboard manufacturer.

## 2.08 MAIN SWITCHES

A. The main switch and any feeder switches fused at 1200 amperes and above shall be bolted contact load break type rated for 240 volts. The switch shall be equipped with Class L fuses and be suitable for use on circuits having available fault currents of 200,000 RMS symmetrical amperes. The switch with all of its associated protective components shall be UL/CSA listed as a package. The switch shall be capable of interrupting currents up to 12x.

B. The stored energy dead front operating mechanism shall include disc springs compressed and released by the operating handle to provide fast positive switching action independent of the speed with which the handle is operated.

C. In order to provide for easy operation and insure charge before close action, the manual closing shall be accomplished by a two stroke sequence whereby the opening spring is charged and latched before and independent of compression of the closing spring. Opening of the switch shall be accomplished electrically by solenoid or manually by mechanical pushbutton with no movement of the handle. The operating handle shall be mechanically interlocked with fuse access door and have provisions for padlocking in open position.

D. Switch shall be equipped with blown fuse protection to provide automatic trip if any fuse fails, including blown fuse indicating light and phase failure relay with capacitor trip.

## 2.09 FEEDER SWITCHES


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A. Distribution section individual switching devices shall be fusible, 3 pole, quick-make, quick-break, 250 volt hinged door type sized as shown on drawings.

B. Switches shall bolt directly to the buses and shall be front accessible, heavy duty type.

C. Switches shall be individually enclosed in a steel compartment so that no live parts are accessible to the operator whether the door is open or closed.

D. Switches shall have solderless lug connectors with line shields. Contacts shall be silver alloy with spring reinforced fuse clips and suitable to accept only Class R fuses. Provide factory or field installed rejection kits to prevent use of other fuse types.

E. The door shall be interlocked with the switch mechanism so that with the switch energized the door cannot be opened and vice versa. Door latch shall be equipped with means for double padlocking.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Install switchboards in accordance with the NEC as shown on the drawings and as recommended by the manufacturer.

B. Provide raised concrete bases for all floor mounted switchboards. Bases shall be 4" high where possible but at least 2" minimum. Pad sizes shall be based on exact equipment size as determined from shop drawings. Provide concrete pads as described above unless they are shown or specified to be provided by the General Contractor.

C. Verify with system design the proper voltage rating for the switchboard assembly and for unit switches and circuit breakers.

D. Provide proper bracing of service entrance conductors. Obtain from the manufacturer a drawing that shows the required cable wrapping or lashing requirements and install accordingly.

E. Anchor switchboards to the floor with plated 1/2-inch minimum anchor bolts as recommended by the manufacturer.

F. Mount the switchboards on two channel iron sills, leveled and grouted flush into the floor. Sills shall suit the switchboards. Anchor the switchboards to the floor with plated 1/2-inch anchor bolts.

**END OF SECTION**


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**SECTION 262416**

**PANELBOARDS**

## PART 1 GENERAL

### 1.01 SCOPE

A. This section includes the furnishing, installation and connection of panelboards.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260526 - Grounding and Bonding of Electrical Systems

C. Section 260553 - Identification for Electrical Systems

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit shop drawings for all panelboards.
      a. Include electrical ratings, dimensions, mounting, material, wiring diagrams and accessories.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Panelboards: Cutler-Hammer, General Electric, Siemens, Square D.

### 2.02 PANELBOARDS

A. Panelboards shall be in accordance with UL, NEMA, NEC and as shown on the drawings.

B. Provide standard manufactured products. All components of panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards to be of the same manufacturer.

C. All panels shall be dead front safety type. Arrange sections for easy removal without disturbing other sections.

D. All panelboards shall be completely factory assembled with molded case circuit breakers.

E. Panels shall have main breaker or main lugs, bus size, voltage, phase, top or bottom feed and flush or surface mounting all as scheduled on the drawings.

F. All panelboards shall come with clear plastic covered, typed circuit directory mounted in a metal cardholder. Schedule shall identify circuits by room number using final room numbers furnished by the Owner.


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G. Circuit breaker panelboards shall have the following features:
   1. Non-reduced size aluminum bus bars, and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of branch circuit devices.
   2. Full size neutral bar, mounted on insulated supports.
   3. Ground bar with sufficient terminals for all grounding wires.
   4. Provide isolated ground bar for panelboards supplying isolated ground type receptacles.
   5. Buses braced for the available short circuit current, but not less than 10,000 amperes symmetrical for 120/208 volt systems and 14,000 amperes symmetrical for 277/480 volt systems.
   6. All breakers arranged so that it will be possible to substitute a two-pole breaker for two single pole breakers and a three-pole breaker for three single pole breakers, when frame size is 100 amperes or less.
   7. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors and without machine drilling or tapping.
   8. Where designated on panel schedule as "space", include all necessary busing, device support and connections. Provide all devices continuous such that all devices are grouped together and all spares are grouped together to eliminate the need to move devices when future multiple pole devices are added. Provide blank cover for each space.
   9. In two section panelboards, the main bus in each section shall be full size. The first section shall be furnished with sub-feed lugs on the line side for cable connections to the second section.

**2.03 CABINETS AND TRIMS**

A. Cabinets - Circuit Breaker Type:
   1. Provide galvanized steel cabinets to house panelboards. Cabinets for distribution panels may be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
   2. Back and sides shall be of one piece formed steel. Cabinets for distribution panels may be of formed sheet steel with end and side panels welded, riveted or bolted as required.
   3. Provide minimum of four interior mounted studs and necessary hardware for "in" and "out" adjustment of panel interior.
   4. Cabinets for two section panelboards shall have both sections bolted together, arranged side by side, and shall be the same height. Flush mounted cabinets should be 1-1/2 inches apart and coupled by conduit nipple.
   5. Gutter sizes in panel boxes, on all sides, shall be in accordance with the NEC. Cabinets containing through feeders shall have the gutter space increased by the amount required for auxiliary gutters in the NEC.

B. Trims - Circuit Breaker Type
   1. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
   2. Flush trims shall overlap the box by at least 3/4-inch all around.
   3. Surface trim shall have the same width and height as the box.
   4. Secure trims to back boxes by indicating concealed trim clamps.
   5. Provide a welded angle on rear of trim to support and align trim to cabinet.
   6. Provide separate trims for each section of multiple section panelboards. Trims and doors of sections shall be of the same height.


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C. Doors - Circuit Breaker Type
   1. Provide door-in-door type front with flush type latch and manufacturer's standard lock. Doors over 48 inches in height shall have a vault handle and a three point catch, arranged to fasten door at top, bottom and center.
   2. In making switching devices accessible, doors shall not uncover any live parts.
   3. Provide concealed, butt hinges welded to the doors and trims.
   4. For magnetic contactors incorporated in panelboards, provide separate doors for the contactors.
   5. Furnish panelboards with latch and manufacturer's standard lock, except panels with doors over 48 inches in height.
   6. Provide keyed alike system for all panelboards.

**2.04 MOLDED CASE CIRCUIT BREAKERS FOR PANELBOARDS**

A. Breakers shall be UL listed and labeled, in accordance with the NEC, as shown on the drawings, and as herein specified.

B. Circuit breakers in panelboards shall be bolt-on type for 120/208 volt system.
   1. Molded case circuit breakers for lighting and appliance branch circuit panelboards shall have minimum interrupting rating as follows:
      a. 120/208 volt panelboards: 10,000 amperes symmetrical.
   2. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for 100 ampere frame or less. Magnetic trip shall be adjustable from 3X to 10X for breakers with 600 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.

C. Breaker features shall be as follows:
   1. A rugged, integral housing of molded insulating material.
   2. Silver alloy contacts.
   3. Arc quenchers and phase barriers for each pole.
   4. Quick-make, quick-break, operating mechanisms.
   5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.
   6. Electrically and mechanically trip free.
   7. An operating handle, which indicates ON, TRIPPED and OFF positions.
   8. Line connections shall be bolted or plug in as specified above.
   9. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
   10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory.
   11. Shall be switch rated when used to control lighting circuits.
   12. Shall be ground fault circuit interrupted type where circuits/loads supplied are required per N.E.C. to be ground fault protected.
   13. Shall be arc fault circuit interrupted type where circuits/loads supplied are required per N.E.C. to be arc fault protected.

**PART 3 EXECUTION**

**3.01 INSTALLATION**


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A. Installation shall be in accordance with NEC, as shown on the drawings, and as herein specified. Coordinate with other divisions to insure that piping, ductwork, etc., is not installed in violation of NEC or local authority requirements for equipment clearances.

B. Balance the loads on all phases and rearrange branch circuiting if required, for balancing.

C. Locate panelboards so that the present and future conduits can be conveniently connected. Coordinate the sizes of cabinets with designated closet space.

D. Mount the panelboard so that maximum height of circuit breakers above finished floor shall not exceed 78 inches. For panelboards which are too high, mount panelboard so that the bottom of the cabinets will not be less than six inches above the finished floor.

E. Circuit numbers indicated on the drawings are shown for the purpose of clarifying the grouping of outlets. The actual number assigned to the circuit in the panelboard shall suit the busing and branch circuiting to the panel. Panelboard schedule shall identify circuits using final room numbers furnished by the Owner.

F. Identify the panelboard name and power supply source on the inside of door. Power supply source nameplate nomenclature shall be as follows: "*Feeder Power Supply for "Panel xxx" Originates at Panel xxx*". Provide nameplates on outside in unfinished and electrical rooms and inside door for finished areas.

G. Flush mounted panelboards shall be provided with empty conduits stubbed up to an accessible location. Provide one 3/4" C for every three pole breaker spaces, spares or combination.

**END OF SECTION**


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**SECTION 262726**

**WIRING DEVICES**

## PART 1 - GENERAL

### 1.01 SCOPE

A. This section includes the furnishing, installation and connection of wiring devices.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260533 - Raceway and Boxes for Electrical Systems

C. Section 260526 - Grounding and Bonding for Electrical Systems

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit sample of receptacle and coverplate.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Receptacles and Switches - Cooper (#5362), Hubbell (#5362), Leviton (#5362A), and Pass & Seymour (#5362A).

B. Wall Plates - Hubbell, Leviton, Pass & Seymour, and Cooper.

C. Metal surface raceways - Wiremold, or Walker.

### 2.02 RECEPTACLES

A. Duplex receptacles shall be extra hard usage, industrial specification grade rated 20 ampere, 125 volt, 2 pole 3 wire, Nema 5-20R grounded type with impact resistant nylon face and back body polarized parallel slots, one-piece brass strap with integral ground contacts, automatic ground clip, break-off feature for two circuit operation and provisions for back and side wiring of #14 - #10 AWG copper wire. Receptacles shall be in accordance with the latest applicable Federal Specification W-C-596 and NEMA Standard Publication.

B. Receptacles are identified below by Hubbell catalog number; other brands used shall be equivalent or better.


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| RATING | NEMA NO. | HUBBELL NUMBER | REMARKS |
|---|---|---|---|
| 20A-125V,2P-3W duplex | 5-20R | 5362 | One Piece Ground Strap and Contacts, Self-Test Feature |
| 20A-125V,2P-3W duplex | 5-20R | GFR5362SG | Industrial Grade, Self-Test Feature, and Tamper-Resistant |
| 30A-125/250V,3P-4W | 14-30R | 9430A | Dryer |
| 50A-125/250V,3P-4W | 14-50R | 9450A | Range |
| 20A-125V,2P-3W duplex | 5-20R | GF-5362 | Ground Fault |
| 20A-125V,2P-3W duplex | 5-20R | IG-5362 | Isolated Ground |
| 20A-125V,2P-3W duplex | | IG5352-S | Surge Suppressor-IG with Isolated Ground |

C. Receptacles on normal power shall have colors as directed by Architect and determined during shop drawing submittal.

D. Special purpose receptacles are shown on the plans and identified by NEMA designation number or receptacle type (see symbol sheet for specific NEMA type.)

E. Safety receptacles shall limit access to energized contacts. Provide safety receptacles for pediatric, psychiatric, nursery, dwelling units and other locations as required by National Electric Code and as indicated on the drawings.

F. Ground Fault Circuit Interrupter Receptacle: Provide within six feet of all sinks, in maintenance garage areas, for all exterior receptacles, for all vending machines, kitchen area and other areas as required by National Electric Code. Provide self-test feature for all GFCI type receptacles. Provide tamper-resistant style for hospital grade GFCI type receptacles.

**2.03 SWITCHES**

A. Switches shall be specification grade, toggle type side and back wired, rated 20 ampere, 120/277 volt. Switches shall be color coded and in accordance with latest applicable Federal Specification W-S-896 and NEMA WD-1. Color to match receptacles.

B. Switches are identified below by Hubbell catalog number; other brands used shall be equivalent or better.

| Switch Rating | Hubbell No. |
|---|---|
| 20 ampere - single pole, double pole, 3 way, 4 way | 1221 Series |

**2.04 DEVICE COVERPLATES**

A. All flush mounted outlets shall be equipped with finishing coverplates. Provide ganged plates for receptacle or switch groupings.

B. Plates shall be:
1. Type 302 satin stainless steel with smooth flat face and (beveled edge) (contoured edge).


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2. Weatherproof covers for duplex receptacles shall be installed with an outlet enclosure clearly marked "SUITABLE FOR WET LOCATIONS WHILE IN USE". There must be a gasket between the enclosure and the mounting surface, and between the cover and base to assure a proper seal. The enclosure must employ stainless steel mounting hardware and be constructed of impact resistant polycarbonate. The outlet enclosure shall be listed by Underwriters Laboratories, Inc. Enclosure must be manufactured by TayMac Corporation, Cooper, or equal. Mount receptacle vertically.

C. Coverplates for surface mounted boxes in unfinished spaces shall be raised cover galvanized steel manufactured for the purpose.

**2.05 MISCELLANEOUS DEVICES**

A. Pilot lights, other than three phase motor starter pilots shall be neon lamp and red-prism rated for voltages at which applied.

**2.06 METAL SURFACE RACEWAYS (MULTI-OUTLET ASSEMBLIES)**

A. Federal Specification W-C-582 and UL 5 shall apply.

B. Thoroughly clean, phosphatize and paint the steel enclosures at the factory with primer and the manufacturer's standard baked enamel finish.

C. Spacing of the receptacles along each strip shall be as indicated on the drawings.

D. Wires within the strips shall not exceed the wire capacities recommended by the manufacturer.

E. Installation fittings shall be provided for the strips being installed including bends, offsets and elbows.

F. Metal surface raceways shall be as follows. Wiremold numbers are used to identify sizes and features required.
1. No. G-3000 1-17/32" x 2-3/4" with snap-on cover and gray finish. Provide grounding type duplex receptacles and plates as specified under RECEPTACLES and PLATES this section.

**2.07 FLOOR OUTLETS**

A. Furnish all material to install floor boxes as indicated on the electrical drawings and described in this section.
1. Standard boxes on grade or below for concrete pours two inches and greater shall be round cast steel with a polyester corrosion resistant finish. It shall have 1-1/4" prior to and 3/8" after pour angular and vertical adjustments. The box shall have four 3/4" tapped hubs and shall be 3” deep. Box shall have removable top for simplified wiring. The floor box shall accept a standard duplex receptacle.
2. Each box shall contain a removable top for simplified wiring. The floor box shall accept a standard duplex receptacle and telecommunication outlets.
3. Covers for above boxes shall be brass or aluminum (verify with architect) equipped with required number and sizes of threaded opening to accommodate the receptacle or device therein.
4. Dual service hinged cover floor boxes shall be constructed of 14 gauge galvanized steel with corner supports and leveling screws. Box shall be complete with:


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a. 20A, 125 volt grounding type duplex receptacle with faceplate to separate power and communication compartments. If box manufacturer does not furnish receptacle, the Contractor shall furnish and install.
b. Leveling ring faceplate.
c. Injection molded phenolic plastic hinged access cover with Velcro attachment pads.
d. Exposed carpet flange types shall have color as specified by architect.
e. Assembly shall be UL listed.
f. Floor boxes shall be Wiremold RFB4 series.

## PART 3 EXECUTION

### 3.01 GENERAL

A. Installation shall be in accordance with the NEC and as shown on the drawings.

### 3.02 RECEPTACLES

A. When installed as split-wired connect top receptacle to switched circuit.

B. Receptacles supplied by GFCI type circuit breakers shall be labeled as “Ground Fault Protected”.

C. Receptacles noted as "AB" (Above Backsplash) shall be mounted in the vertical plane three (3) inches above the counter backsplash. Where vertical mounting is not possible mount in the horizontal plane three (3) inches above the counter backsplash. Coordinate exact height of counter backsplash above finished floor with architectural elevations and construction trades installing floor cabinetry backsplash. If no backsplash, then mount three (3) inches above countertop.

D. Weatherproof receptacle outlet boxes shall be mounted horizontally when required by the cover configuration so cable access is on the bottom.

### 3.03 SWITCHES

A. Mount switches at strike side of doors.

B. Provide outlet box barriers between switches occurring in the same multi-gang box when voltage between adjacent switches exceeds 300 volts.

C. Switches for isolated ground circuits shall be double pole.

### 3.04 PLATES

A. Provide engraving WHEN indicated on the plans with 3/16" high letters and contrasting paint fill.

### 3.05 METAL SURFACE RACEWAYS (MULTI-OUTLET ASSEMBLIES)

A. Install and connect insulated green ground wire in all metal surface raceways. Install raceways and fittings parallel and perpendicular to the building lines, complete with all necessary fittings for a complete raceway system.


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**END OF SECTION**


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**SECTION 262774**

**ELECTRIC HEATERS**

## PART 1 GENERAL

### 1.01 SCOPE

A. Work under this section includes the furnishing and installing of all electric heating equipment (and heat cables) as indicated on drawings and specified herein. Provide all wiring and connections shown and control devices where indicated.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below)

C. Section 260526 - Grounding and Bonding for Electrical Systems

D. Section 260533 - Raceway and Boxes for Electrical Systems

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit shop drawings for all types of electric heaters specified including KW, voltage and phase ratings, dimensions, finishes and auxiliary and control devices.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Electric Baseboard Heaters – Raywall RDBT-PD Series.

B. Electric Wall Heaters – Qmark SSHO4008 Series.

C. Electric Cabinet Unit Heater – Qmark CU900 Series.

D. Heat Cable - Chromalox, Raychem, Easy Heat.

E. Hand/Hair Dryers - World Dryer Corp., Bobrick, Excel and American.

### 2.02 GENERAL

A. All electric heaters and equipment shall be UL listed and labeled.

B. Electric ratings of heaters shall be as shown on the drawings. Verify that KW, voltage and phase ratings shown are proper for the voltage system and circuits shown.

### 2.03 ELECTRIC BASEBOARD HEATERS


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A. Heaters shall be decorative pedestal type, furnished in pre-assembled standard lengths as required. Enclosures shall be fabricated from minimum 24 gauge cold rolled steel for residential grade and 18 gauge for commercial grade, welded and electro-deposition enamel coated in clear anodized aluminum finish. Heater body shall include integral wiring raceway.

B. Heaters shall be commercial grade convection type, 208 volt, rated for 250 watts per lineal foot.

C. Heating elements shall consist of nickel-chromium wire encased in an aluminum sheath with attached aluminum fins. Element leads shall be insulated and terminated at each end in terminal boxes. Heating element and fins shall be freely suspended and independent from the heater body.

D. Linear thermal cutouts shall be provided to automatically shut off heater in event of overheating and reactivate when temperatures return to normal.

E. Provide remote thermostat with relay modules for each heater section.

F. Provide blank section raceway kits in standard lengths.

G. Provide tamperproof thermostat kits for public area heaters.

## 2.04 FORCED FAN WALL HEATERS

A. Heaters shall be suitable for wall recessed or surface mounting as shown on architects drawings, and shall be UL listed. Back box and inner housing shall be 18 gauge cold rolled steel, 4000 watt, 208 volt, single phase.

B. Heating element shall consist of non-glowing resistive wire enclosed in a metal sheath with brazed fins attached.

C. Unit shall include fan and motor, adjustable thermostat, fan control and thermal cutout to automatically shut off heater in the event of overheating and reactivate when temperatures return to normal.

D. Electronic thermostat range shall be 45 degrees to 105 degrees F and air movement shall be 65 CFM minimum. Provide LCD touch screen display.

E. The front cover (and sides if surface mounted) shall be 20 gauge steel (color selected by architect) with ventilation louvers.

F. Provide on/off disconnect switch.

G. Provide tamperproof type covers for heaters in public spaces.

H. Provide built-in BMS connection capability.

## 2.05 CABINET UNIT HEATERS

A. Heaters shall be UL approved and designed for mounting in any position and fully recessed, semi-recessed and surface mounted, 6000 watts, 208 volt, 3 phase.


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B. The cabinet shall be of heavy duty 16 gauge cold-rolled steel and shall have a hinged front door for easy access to the control panel. The heater front panel shall be easily removable for access to elements, motor-blower assembly, filters and all internal components. The cabinet shall be finished in manufacturer's standard tan baked enamel. Air flow shall be front in - front out.

C. The heating elements shall be of non-glowing design consisting of a special resistance wire enclosed in a steel sheath to which steel plate fins are brazed. Thermal safety cutouts shall be built into the system to automatically shut off heater in event of overheating due to any cause.

D. The motors and blowers shall be direct drive and resiliently mounted on a rigid heavy gauge frame. Individual motors shall be no larger than 1/8 HP, multi-speed, permanent split capacitor type with built-in automatic reset overload protection. The blowers shall be forward curved double inlet centrifugal. Unit shall include an easily accessible disposable air filter.

E. Fan control shall be bi-metallic snap-action type and shall activate fan after heating elements reach operating temperature, and continue to operate fan after the thermostat is satisfied and until heating elements are cool. Three fan speeds and continuous or automatic fan shall be selectable by means of pushbutton switches.

F. Unit shall include integral or remote 2-stage thermostat for a control range of from 40 degrees to 120 degrees F.

## 2.06 HEAT CABLES

A. Provide heat cables for mechanical piping for rain leaders, roof gutter deicing.

B. The self-regulating heater cables shall consist of a flat flexible electric heating strip of parallel circuit construction, consisting of a continuous inner core of self-regulating conductive polymer material. This core shall be insulated with a corrosion resistant modified polyolefin outer jacket.

C. The self-regulating heater shall increase its heat output with a decrease in temperature and decrease its heat output with an increase in temperature without the use of thermostat controls. A constant wattage heater is not acceptable.

D. The heater shall be rated for 9 watts per lineal foot and shall be UL listed and labeled. Provide all necessary splice kits, power connection kits, end seals, tees and expansion joint kits as necessary for a complete installation. Electric power connections shall be made in accessible junction boxes.

E. Provide thermostat control for each system as shown with positive off control at 40 degrees F and capillary for sensing outside temperature.

## 2.07 HAND AND HAIR DRYERS

A. Dryers shall be flush or surface type and U.L. listed. Flush mounted units shall include wall box.


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B. Construction of cover shall be one piece gray iron casting with acid-resistant porcelain enamel finish.

C. Motor shall be universal type, 1/10 HP, 7500 rpm with resilient mounting and sealed lubricated ball bearings and fuse protected.

D. Fan shall be double inlet centrifugal type and deliver 152 cfm at the outlet.

E. Heating element shall be protected by an automatic resetting circuit breaker.

F. Color to be selected by architect.

## PART 3 EXECUTION

### 3.01 GENERAL

A. Provide proper anchors and supports for heaters for a secure installation.

B. Verify mounting heights for wall heaters. For convection heaters provide installation according to manufacturer's recommendations to assure proper clearance from finished floor to allow correct air movement.

C. Where remote low voltage thermostats are indicated, coordinate with requirements of Division 22 and verify relay voltage required.

### 3.02 HEAT CABLES

A. Coordinate installations with requirements of Division 22.

B. Install cables on pipes in a linear fashion and on the bottom of horizontal pipes. Provide proper fasteners or ties so that insulation by others can be readily installed. Verify that thermostat controls are not covered by insulation. Insulation of the pipe and cable will be done under Division 22.

C. Roof gutter deicing cables shall be installed per manufacturer's recommendations. Use caution where cables are secured and clamped to roof or gutter for proper support. Damaged cables shall be completely replaced.

### 3.03 DRYERS

A. Surface dryers shall be fastened to the wall with 4 long 1/4" toggle or expansion bolts.

B. Verify mounting heights with Architect/Engineer for hand and hair dryers.

**END OF SECTION**


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**SECTION 262812**

**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

## PART 1 GENERAL

### 1.01 SCOPE

A. Work under this section includes the equipment and complete installation for enclosed switches and circuit breakers as specified and indicated on the drawings complete with fuses for all HVAC and electrical equipment.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260526 - Grounding and Bonding for Electrical Systems

C. Section 260553 - Identification for Electrical Systems

D. Section 262416 - Panelboards

E. Section 262813 - Fuses

### 1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Division 1, for each disconnect switch size including rejection fuse clips and enclosure types specified.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Safety switches - Cutler Hammer, General Electric, Siemens-ITE, Square D, or Furnas.

B. Circuit breakers - Cutler-Hammer, General Electric, Siemens-ITE, or Square D.

### 2.02 SAFETY SWITCHES

A. Low voltage fusible switches 600 amps and less shall be in accordance with UL File E2875, NEMA KSI, NEC and Fed. Spec. W-S-865C.

B. Shall be equipped with cartridge fuses as shown on the drawings or as required.

C. Shall have the following features:
   1. Switch mechanism shall be the quick-make, quick-break type, rated for system voltage.
   2. Copper blades, visible in the OFF position with an arc chute for each pole.
   3. Spring loaded fuse clips with factory or field installed rejection device for Class R fuses.
   4. External operating handle shall indicate ON and OFF position and shall have lock-open padlocking provisions.


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5. Mechanical interlock shall permit opening of the door only when the switch is in the OFF position, defeatable by a special tool to permit inspection.
6. Solid neutral for each switch being installed in a circuit which includes a neutral conductor.
7. NEMA Type I enclosure except outdoors and damp or wet locations provide NEMA Type 3R.
8. Electrical interlock when used in conjunction with separately derived control circuit.

D. Safety switches shall be heavy duty type HD and horsepower rated.

### 2.03 MOLDED CASE CIRCUIT BREAKERS

A. Where separately enclosed molded case circuit breakers are shown on the drawings, provide circuit breakers in accordance with the applicable requirements of those specified for panelboards, specification Section 262416.

B. Enclosures are to be of the NEMA types shown on the drawings. Where the types are not shown, they are to be the NEMA type most suitable for the environmental conditions where the breakers are being installed.

## PART 3 EXECUTION

### 3.01 ENCLOSED SAFETY SWITCHES AND CIRCUIT BREAKERS

A. Provide fusible safety switches or enclosed disconnects sized as required or as shown for all motors and fixed equipment.

B. Non-fused safety switches may be used for maintenance disconnects only where permitted by code.

C. A safety switch or other disconnect shall be provided adjacent to each motor and fixed equipment, except where the power distribution center is not over 50 feet distant and within sight from the motor.

**END OF SECTION**


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**SECTION 262813**

**FUSES**

## PART 1 GENERAL

### 1.01 SCOPE

A. Work under this section includes the furnishing of all fuses for all HVAC and electrical equipment.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 262418 - Equipment Connections

C. Section 262419 - Motor Control Centers

D. Section 262812 - Enclosed Switches and Circuit Breakers

E. Section 262913 - Enclosed Controllers

### 1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Division 1.

B. Submit time current curves for all fuses being supplied as part of this project.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Fuses - Bussmann/McGraw Edison, Brush, Mersen (formerly Ferraz-Shawmut) or Littelfuse.

B. Fuse cabinet - Bussmann, Littelfuse or Square D.

### 2.02 FUSES

A. Furnish and install secondary fuses in all fusible equipment sized as shown on the drawings.

B. All fuses shall be current limiting non-renewable type with 200,000 ampere AIC interrupting capacity and shall not be shipped installed in fusible equipment.

C. Fuses shall be by the same manufacturer of the types specified below. Bussmann fuse references are listed to establish type and quality.

D. Fuses 600 amperes and less shall be U.L. Class R, rejection type fuses.

| Time Delay | Time Delay | Fast Acting |
|---|---|---|


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| | | |
|---|---|---|
| Class RK-1 | Class RK-5 | Class RK-1 |
| Bussmann | Bussmann | Bussmann |
| Low-Peak | Fusetron | Limitron |
| LPN-RK-250V | FRN-R-250V | KTN-R-250V |

E. Fuses over 600 amperes shall be UL Class L (with pure silver links only).

| Time Delay | Fast Acting |
|---|---|
| Class L | Class L |
| Bussmann | Bussmann |
| Hi-Cap | Limitron |
| KRP-C | KTU |
| Silver Links | Silver Links |

F. Apply specific fuses as follows:

| | |
|---|---|
| Main Switch | - Hi Cap |
| Panel Feeders | - Fusetron |
| Motors | - Fusetron |
| Equipment | - Fusetron |
| Elevators | - Fusetron |
| Special Use Non-Motor | - Limitron |

G. Provide a minimum of three additional spare fuses of the type, size, and rating for each set installed.

H. Provide a fuse cabinet for storing spare fuses and puller. Provide an insulating type universal fuse puller. Fuse cabinet shall contain hinged and latched front cover, be designed for surface mounting, and be made of code gauge steel, Bussmann #SFC, Littelfuse #LSFC, or Square D #TC-36356B box and #TC-36356TS cover. Locate panel as directed by Owner or as located on drawings.

## PART 3 EXECUTION

### 3.01 FUSES

A. The size, voltage and fuse type furnished for each device shall be indicated inside the cover of that device with pressure sensitive tape.

B. Install spare fuse cabinet adjacent to main switchboard or where shown on drawings. Label cabinet as "FUSE CABINET" per instructions contained in Section 260553. Verify location with Owner.

C. Spare fuses shall be placed in the fuse cabinet in their original shipping containers.

**END OF SECTION**


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# SECTION 262913

# ENCLOSED CONTROLLERS

## PART 1 GENERAL

### 1.01 SCOPE

A. The work under this section includes furnishing, installing and connecting all enclosed controllers as indicated and scheduled on the drawings.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260522 - Manufactured Wiring Assemblies

C. Section 260526 - Grounding and Bonding for Electrical Systems

D. Section 260553 - Identification for Electrical Systems

E. Section 262419 - Motor Control Centers

F. Section 262812 - Enclosed Switches and Circuit Breakers

G. Section 262813 - Fuses

H. Divisions 21, 22, and 23 - All sections regarding motorized equipment.

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Enclosed controllers - Allen-Bradley, Cutler-Hammer, General Electric, Siemens-ITE, or Square D.

### 2.02 ENCLOSED CONTROLLERS

A. Motor starting switches, MSS, shall be snap action toggle switch type in NEMA 1 enclosure, which clearly indicate ON, OFF, and TRIP position, complete with thermal overload protection. Motor starting switches, installed in finished areas or control panels shall be flush mounted. Pilot lights where needed as indicated on drawings shall be LED type with clear or amber lens.

B. Magnetic starters shall be full voltage, non-reversing type with overload protection in each ungrounded line, low voltage protection or release and external manual resets. The starters shall have heavy duty, green running pilots, hand-off-auto selector switches, or on-off push buttons mounted in the starter cover as noted in the Motor Schedule. Individual motor starters shall be furnished in NEMA 1 enclosure. Starters for 208 volt motors shall be provided with


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line voltage rated coil unless otherwise scheduled. Provide one auxiliary contact switch pilot duty rated for each starter and additional contacts as indicated in the Motor Schedule or as required for interlocks and other automatic control devices.

C. Provide combination starters where shown or where practical. Fused disconnect part of the combination starter shall be in conformance with Section 262812 - Enclosed Switches and Circuit Breakers.

D. Control Devices
   1. Provide heavy duty transformer style push-to-test green running pilots and hand-off-auto selector switch station for each motor, unless otherwise noted. In general, these devices shall be located in the starter cover or control station cover. Control devices located remote from the starter shall be heavy duty type. They shall be flush mounted in finished areas and on remote control panels where grouped.
   2. Hand-off-auto control devices shall be connected so that motor will run in the "hand" position regardless of external automatic control device or interlocking condition. However, do not bypass devices which are intended to prevent motor from running for safety reasons or to prevent equipment damage.

## PART 3 EXECUTION

### 3.01 ENCLOSED CONTROLLERS

A. Provide all starters and disconnects for all motor and electrical equipment as shown in the motor schedule and on the drawings.

B. Motor starting equipment, including remote control and/or indicating stations, shall be identified in accordance with Section 260553.

C. Be responsible for the provisions of adequate auxiliary contacts and/or relays to accommodate interlock and subsidiary control connections stipulated. Coordinate work with the Mechanical and Temperature Control Contractor such that the operation of mechanical equipment will be as described in mechanical specifications.

D. Starters shall be by the same manufacturer.

E. Provide weatherproof enclosures for starters and disconnects in outdoor and wet locations.

F. At each grouping of individual component motor control equipment, e.g., starters, switches, etc., furnish and install a 3/4" plywood mounting board and horizontal square wireway. Plywood shall have two coats of flame retardant gray enamel.

G. Verify motor feeder sizes, fuse sizes, rotation, etc., recommended by equipment manufacturer before installing. Make motor connections with a maximum of 24" Greenfield or Sealtite and separate ground wire.

H. For fractional horsepower motors on mechanical equipment, provide horsepower rated disconnect switch and thermal overload protection, as required by NEC. Overload units shall be sized approximately 125% full load motor current. Check and coordinate all thermal protective devices with the equipment they protect.

I. For motor feed through VFDs, provide branch circuit to VFD and from VFD to motor. Where VFDs are furnished by others, provide mounting as per manufacturer's written installation instruction. Provide disconnects for each VFD that is not furnished with a disconnect.


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J. Provide temporary wiring if necessary, for permanent building heating system equipment put in service by the Heating Contractor after building is enclosed. Verify requirements with Division 14.

K. Furnish and install a non-fused disconnect switch at each motorized unit not supplied with a switch for maintenance purposes.

L. Provide power feed for elevator(s) and lockable disconnect(s) including feeders from load side of disconnect to elevator control panel. Provide ground wire sized per the NEC between the power source and the controller. Provide auxiliary contacts in disconnect and wiring to elevator controller per Division 14 requirements for elevator controls. Provide lockable fused disconnect and dedicated 15 amp 120V circuit for each elevator cab. Circuit shall come from nearest 120V life safety emergency panel, if available, or 120V normal panel. Elevator machine room receptacle, elevator pit receptacle/lights shall each have dedicated circuits. Receptacles shall be of GFI type. Elevator machine room lighting may be on the same circuit as elevator machine room receptacle circuit unless lighting is of a different voltage. Specific location for electrical equipment in elevator machine rooms and elevator pit shall be coordinated with elevator supplier and installer. Refer to fire alarm specification for fire alarm system requirements.

M. Provide emergency boiler control station at each exit from boiler room(s). If the exit egresses to the building interior, locate the switch outside the boiler room. If the exit egresses to the building exterior, locate the switch inside the boiler room. Coordinate all locations with the local AHJ prior to installation. Provide Asco 124323 break glass control station at each boiler room exit with control wiring to Asco 917 mechanically held 20 amp contactor with two wire control. Provide one pole per each boiler circuit. Contactor shall be mounted in NEMA 1 enclosure in boiler room and labeled as to functions. Refer to detail on the drawings where shown.

N. Where unit heaters or circulating pumps are shown on the drawings provide electrical connection to controlling aquastats, valves, etc., all as required for proper control as specified by Mechanical Contractor.

O. Provide power outlets, fused disconnect and connections for heat pumps.

P. Provide all connections as required for float switches, alternators, pressure switches, etc. and other devices indicated in the motor schedule and as specified by Mechanical Contractor.

Q. For package mechanical equipment scheduled on drawings provide a disconnect switch, unless provided by Mechanical Contractor, at the unit and make a power connection to the integral mounted starter/control panel provided with the unit. Disconnect shall be fused unless otherwise noted on the drawings. All automatic controls and associated wiring will be provided complete integral with the unit. For rooftop units, provide fused weatherproof disconnect switch, unless provided by Mechanical Contractor 15, and 20A, 120V weatherproof ground-fault protected service receptacle mounted on the unit housing on a separately derived circuit.

R. Make all connections to power roof ventilators in such a way that all conduit and wiring shall be covered by the unit. Obtain dimensions of the actual equipment from the Contractor furnishing same and make connections accordingly.


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S. Install double duplex receptacle outlet at each wall hung water cooler such that the receptacle will be concealed behind the cooler enclosure. Provide GFCI protected circuits for electric water coolers. Install 120V receptacle for dryer at each temperature control compressor location.

T. Provide 120 volt receptacle for chemical feed pump at each chemical feed tank assembly. Provide a dedicated circuit. Coordinate location(s) with Division 23 and 24.

U. Provide a 20 ampere, 120 volt circuit to each temperature control panel location and terminate at junction box for extension by Mechanical Contractor. Where emergency power is available on the project and is being provided to mechanical equipment, temperature control panel 120 volt power shall be provided from an emergency power supplied panel board.

V. Install and connect automatic fan shutdown systems in supply and return air systems of 2000 cfm or larger as indicated on the drawings and specified in Section 283101.

**END OF SECTION**


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**SECTION 264300**

**SURGE PROTECTIVE DEVICE (SPD)**

## PART 1 GENERAL

### 1.01 SCOPE

A. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all AC electrical circuits.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260526 - Grounding and Bonding for Electrical Systems

C. Section 260553 - Identification for Electrical Systems

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Shop drawing shall include listing documentation verifying the following:
      a. Short Circuit Current Rating (SCCR)
      b. Voltage Protection Ratings (VPR) for all modes
      c. Maximum Continuous Operating Voltage Rating (VCOV)
      d. Nominal Discharge Current Rating (In)
      e. Type 2 device listing

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Current Technology, Eaton-Innovative Technology, G.E., LEA International, Mersen, Siemens, Square D, or approved equal.

### 2.02 PERFORMANCE

A. General
   1. SPD shall be Listed in accordance with UL 1449 3rd Edition and shall bear the UL Mark.
   2. SPD shall be evaluated and tested to be suitable as a Type 2 SPD in accordance with UL 1449 3rd Edition.
   3. SPD shall be a self-contained module design. Each suppression element shall be MOV based.
   4. SPD shall be UL 1449 3rd Edition tested and listed to the Short Circuit Current Rating (SCCR) listed elsewhere in this section in compliance with NEC 285.6.
   5. SPD shall contain EMI/RFI filtering as listed elsewhere in this specification.
   6. SPD shall be equipped with onboard visual diagnostic monitoring. Indicator lights shall provide full time visual diagnostic monitoring of the operational status of each phase of the surge current diversion module. A set of Form C dry contacts shall be provided for remote annunciation of loss of power to any of the phases.
   7. All SPD units shall be provided by the same manufacturer.


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8. Provide an integral audible diagnostic monitoring system which shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided on the front of the unit. The diagnostic monitoring circuits shall continually monitor the operation status of the SPD module. A diagnostic system press to test switch shall be provided. The module shall be equipped with a transient event counter, located on the front cover. The counter shall be equipped with a manual reset and a battery to retain memory on loss of power.
9. The SPD shall provide surge current paths for all modes of protection:
   a. L-N, L-G, L-L and N-G for Wye systems
   b. L-N, L-G and L-L for Wye system when N-G bonding is specified at SPD application point.
   c. L-L, L-G in Delta and impedance grounded Wye systems.

## 2.03 ELECTRICAL DISTRIBUTION EQUIPMENT PROTECTION

A. Service Entrance Protection
   1. SPD shall meet or exceed the following criteria:
      a. Minimum single pulse surge current capability shall be 250 kA per phase and 125 kA per mode.
      b. UL 1449 3rd Edition, 2005 Rev Effective 9/2009, Listed and Recognized Component Voltage Protective Ratings (VPR) shall not exceed the following:

| VOLTAGE | L-N | L-G | N-G | L-L |
|---|---|---|---|---|
| 208Y/120 | 700V | 700V | 700V | 1200V |
| 480Y/277 | 1200V | 1200V | 1200V | 2000V |

      c. The unit shall include a UL 1283 high-frequency extended range tracking filter. The filter shall reduce fast rise-time, high-frequency, error-producing transients and electrical line noise to harmless levels thus eliminating disturbances which may lead to system upset. The filter shall provide minimum insertion loss as follows:

| ATTENUATION FREQUENCY | 100 KHZ | 1 MHZ | 10 MHZ | 100 MHZ |
|---|---|---|---|---|
| INSERTION LOSS (db) | 41db | 31db | 35db | 53db |

      d. Maximum Continuous Operating Voltage (MCOV) shall not be less than 125% of the nominal system operating voltage.
      e. SPD shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C.

   2. SPD shall be installed internally to the equipment and connected directly to the buss of the distribution equipment. No cable connection between the bus bar and the SPD unit is allowed.
   3. A UL approved integral disconnect switch shall be provided as a means of disconnect. Disconnect switch shall be directly integrated into the assembly using bolted bus bar connections. SPD enclosure shall not be able to be opened until the disconnect switch is moved into the OPEN position.


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## PART 3 EXECUTION

### 3.01 SYSTEM TESTING AND INSTALLATION

A. Each unit shall be factory tested before shipment. Testing shall include, but not be limited to production-line tests, quality assurance checks, MCOV and benchmark clamping voltage tests. A copy of the benchmark clamping tests for each individual SPD shall be included with each unit with a copy provided to the Engineer/Owner and included in the Operating and Maintenance Manuals.

B. Upon completion of the installation, a factory-authorized local service representative shall provide testing services. The following tests shall be performed:
   1. Voltage measurements from Line-to-Ground, Line-to-Neutral, Line-to-Line and Neutral-to-Ground.
   2. Test results shall be recorded and compared to factory benchmark test parameters supplied with each unit.
   3. A copy of the start-up test results and the factory benchmark testing results shall be supplied to the engineer and the owner for confirmation of proper system function.
   4. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per N.E.C.

**END OF SECTION**


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**SECTION 265100**

**LIGHTING**

## PART 1 GENERAL

### 1.01 SCOPE

A. This section includes the furnishing, installation and connection of all light fixtures complete with lamps and ballasts where shown on drawings and as listed in the fixture schedule.

B. Definitions: The terms “lighting or light fixture(s)”, as used in this specification and on the drawings, shall mean the same as “luminaries” as defined in the National Electrical Code.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below)

C. Section 260526 - Grounding and Bonding for Electrical Systems

D. Section 260926 – Lighting Controls

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit shop drawings for all light fixtures and lamps.
      a. Catalog data and/or shop drawings for fixtures shall include photometric data from an independent testing laboratory.
      b. Catalog data and/or shop drawings for lamps including mercury content for each lamp.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Light fixtures: As listed in the Light Fixture Schedule, with both a factory representation and supplying distributor in the local project area.

B. Lamps: General Electric, Osram-Sylvania, North American Philips, Ushio – MR16 only.
   1. Lamps other than those listed above shall be submitted for approval when furnished with light fixtures.

C. Ballasts:
   1. Electronic Fluorescent – Advance, General Electric, Osram-Sylvania or North American Philips.

D. Emergency Ballasts:
   1. Bodine


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**2.02 LIGHTING FIXTURES**

A. Shall conform to the drawings and fixture schedule, NEC Article 410 and to UL-57, "Electrical Lighting Fixtures".

B. Construction
   1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true and straight, unless intentionally curved, and parallel to each other as designed.
   2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
   3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
   4. Hinged door closure frames shall operate smoothly without binding when the fixtures is in the installed position, and latches shall function easily by finger action without the use of tools.
   5. Light fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vaportight fixtures shall have pressure clamping devices in lieu of the latches.
   6. Lighting fixture closures, lens doors, trim frame, hinged housings, etc., shall be retained in a secure manner by screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.
   7. The manufacturer shall apply his standard finish, unless otherwise specified, over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Fixture finish shall be free of stains or evidence of rusting, blistering or flaking.
   8. Interior light reflecting fixtures shall be white with not less than 85 percent reflectances except where otherwise shown on the drawings.
   9. Exterior finishes shall be as shown in the fixture schedule.

C. Thermal Protection
   1. Recessed fixtures shall have thermal protection or shall be type IC in insulated ceilings. Fixtures shall have a UL label and identification to indicate "thermally protected" or "Type IC". The thermal protector shall be mounted in the fixture and not in the junction box.

D. Individual Light Fixture Disconnect
   1. Provide a disconnection means of individual lights for maintenance purposes.

E. Grounding
   1. Provide all lighting fixtures with a specific means for grounding their metallic wireways and housings to an equipment grounding conductor.

F. Light Transmitting Components for Fluorescent Fixtures
   1. Shall be 100 percent virgin acrylic clear plastic unless specified otherwise in the fixture schedule (polycarbonate, parabolic plastic, glass, etc.)
   2. Shall have a thickness not less than 1/8”.
   3. Unless otherwise specified, lenses and diffusers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.

G. Remote LED driver enclosure
   1. Provide driver enclosure per NEC for LED fixtures utilizing remote drivers. Provide damp


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location rated enclosures where required by driver location.

**2.03 LAMPS**

A. Fluorescent Lamps
   1. T8 – 48” lamps shall be F32T8 rapid start, 32 watts, 3500 degrees K, minimum CRI of 81, minimum of 3100 initial lumens, minimum mean lumens per watt of 90, minimum lamp life of 24,000 hours (at 3 hrs./start), minimum lumen maintenance of 94%, when operated on electronic ballasts and be available in 24" and 36" lengths. Where lamp type and color are shown on Light Fixture Schedule provide lamps as indicated.

B. High Intensity Discharge Lamps
   1. Metal halide lamps shall be clear or phosphor coated and to be provided as scheduled. Provide proper lamp for burning position applicable. Probe start metal halide lamps shall be only used for 750 watt or higher.

C. Lamps shall pass Federal TCLP low mercury limits.

**2.04 LAMP SOCKET**

A. Fluorescent: Lampholders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.

B. High Intensity Discharge, H.I.D.: Shall have porcelain enclosures with nickel plated screw shell. Ceramic metal halide T4.5, T6, T9 lamps shall have 5KV rated lamp socket.

**2.05 BALLASTS**

A. Fluorescent Ballasts
   1. Electronic solid-state ballasts shall be universal voltage (120-277) instant start, operate at high frequency greater than 20 KHZ and meet FCC (Part 18, 15J) for EMI and RFI emissions. Total harmonic content less than 20%, power factor greater than 90%, lamp crest factor less than 1.7, UL listed Class P with a Class A or better sound rating, withstand IEEE 587, Category A transients without damage to components, operate all lamps in parallel, with minimum ballast factor between .85 and 1.0.
   2. Unless otherwise specified elsewhere, electronic ballasts used with ON occupancy sensor control shall be electronic program start.

B. High Intensity Discharge Ballasts
   1. Shall have individual overcurrent protection sized in accordance with the manufacturer's recommendations.
   2. Shall have integral thermal protection where the fixture is recessed in an interior ceiling.
   3. Shall be the constant wattage, high power factor type.
   4. Shall have not less than B sound ratings for interior fixtures, when available. Ballasts which are not available with B ratings shall be of the next standard rating.
   5. All exterior H.I.D. ballasts shall be suitable for starting at -20 degrees F.

**2.06 EXIT SIGNS**

A. General Requirements:
   1. 120/277 VAC 60 Hz operation.


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2. LED optics, individual LED modules shall not be visible.
3. Face color and mounting configuration as indicated on the drawings and on the fixture schedule.

B. Self-Powered Exit Signs (Battery Type):
1. UL924 listed.
2. Battery: Sealed, maintenance-free, nickel-cadmium type delivering 90 minutes capacity.
3. Charger: Fully automatic, solid-state type with sealed transfer relay.
4. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
6. LED Indicator Light.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code required test of unit emergency operation at required intervals.
8. Provide external emergency egress lamps as indicated.

## 2.07 EMERGENCY LIGHTING UNITS

A. General Requirements:
1. UL924 listed.
2. 120/277 VAC 60 Hz operation.
3. Unit color and mounting configuration as indicated on the drawings and on the fixture schedule.
4. Battery: Sealed, maintenance-free, nickel-cadmium type delivering 90 minutes capacity.
5. Charger: Fully automatic, solid-state type with sealed transfer relay.
6. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
8. LED Indicator Light.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code required test of unit emergency operation at required intervals.
10. Provide emergency egress LED lamps as indicated.

## 2.08 LED LUMINAIRES

A. Luminaire
1. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources for complete luminaire testing.
2. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
3. LED luminaires shall deliver a minimum lumens per watt and lumen output as indicated on the fixture schedule.
4. Drivers shall be solid state UL listed and be universal voltage 120-277 VAC at 60 Hz input with a maximum input wattage as indicated in the fixture schedule.
5. The LED driver shall be fully dimmable with continuous dimming without perceivable flicker over a range of 100% to 10% and shall be controlled by a 0 to 10V signal unless


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otherwise indicated on the fixture schedule. Coordinate control requirements with dimming equipment being provided.

6. Luminaires shall have internal thermal protection.
7. Luminaires shall have a minimum CRI of 80 unless indicated otherwise. LED color temperature shall be as indicated in the fixture schedule.
8. LED package(s)/module(s)/array(s)/driver(s) used shall deliver a minimum 70% of initial lumens for a minimum of 50,000 hours.
9. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
10. Thermal management shall be passive by design.
11. Remote LED drivers shall be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

## 2.09 LIGHT FIXTURE SCHEDULE

A. Refer to Light Fixture Schedule on drawings.

## 2.10 ADDITIONAL LIGHT FIXTURES

A. Include in the bid all requirements for the installation of the following light fixture including parts, labor, wiring, etc.
   1. Four (4) additional type **[E or E1]** exit signs each to include fifty (50) feet of conduit and wire.

## 2.11 EMERGENCY BALLASTS

A. Emergency Ballasts
   1. Emergency lighting shall be provided by using a standard fluorescent fixture equipped with an integral battery unit. This battery unit shall consist of a field replaceable, high-temperature maintenance-free nickel cadmium battery, charger and electronic circuitry contained in one 13-3/8” x 2-3/8” x 1-1/2” red metal case. A solid-state changing indicator light to monitor the charger and battery, a double-pole test switch, and installation hardware shall be provided. The emergency battery unit shall be capable of operating 47% initial light output in the emergency mode for a minimum of 90 minutes. The emergency battery unit shall be UL listed for installation inside the fixture, warranted for a full five years from date of purchase. Entire assembly shall be factory installed at the light fixture factory and shipped integral to the fixture. Emergency battery unit shall be similar to Bodine Model B50.

# PART 3 EXECUTION

## 3.01 INSTALLATION

A. Fixtures, in general, have been specified for the particular type of ceiling on which they are to be installed. The Contractor, however, is responsible for verifying the ceiling construction details and furnishing and installing fixtures suitable for the respective ceiling types. Provide plaster frames where applicable.


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B. All suspended type fixtures shall be mounted at heights shown. Mounting heights of ceiling suspended fixtures shall be measured from the finished floor to the bottom of the fixture closures or reflector, and wall mounted fixture height shall be to bottom of fixture unless noted otherwise.

C. Provide adequate supports for all recessed, surface mounted and suspended type fixtures. Such supports shall be anchored to channels in the ceiling construction, using listed clips, to the structural slab or to structural members above the suspended ceiling. For seismic zones 3, 4 and 5, provide safety chain support from structure for all fixtures. Lay-in fluorescent fixtures shall be supported by ceiling grid system and from structure as follows: Provide a minimum of two, #12 gauge, galvanized support wires attached at each corner of the lay-in fixtures. Support wire may be slack and shall be independently secured to building structure above fixtures. Tag or color support wire to distinguish from ceiling support equipment.

D. Provide supplemental support, blocking, etc., within walls at wall bracket mounted light fixtures, whereby both outlet box and/or fixture shall be securely anchored in place.

E. All recessed type fixtures in lay-in ceilings shall have flexible metal conduit connections permitting the fixture to be lifted out. Maximum flexible conduit shall not exceed six feet. One to four light fixtures may be served by a single common outlet box.

F. All fixtures shall be hung straight and true and as design of fixture and accepted practice dictate. All fixtures shall be cleaned before the final acceptance. All fixtures shall be newly lamped and in perfect operating condition at the completion of the job. All necessary devices and auxiliary fittings required for a complete and workmanship installation shall be furnished and installed by this Contractor.

G. Provide and install required fixture retainers or clips for fixtures installed in suspended ceilings.

H. Be responsible for installing fixtures in unobstructed locations in equipment rooms to provide the best possible lighting. Coordinate installation with Mechanical Contractor, Elevator Contractor and other trades.

I. Provide substantial supports for heavy H.I.D. fixtures and chandeliers. Provide wood blocking, threaded rod or steel brackets fastened to joists or other structurally sound members as necessary.

J. All square or round fluorescent light fixtures shall be orientated so all lamps run the same direction in the same room, corridor or definable space.

## 3.05 INSTALLATION IN STONE WORK

A. Coordinate with supplier of all marble, granite or other exposed stone work for installation of recessed light fixtures. Provide supplier with dimensions and locations of openings for receiving light fixture in sufficient time for supplier to prepare opening. All cutting of openings in stone work will be done by the furnishing contractor, including all patching and sealing around light fixture openings.

**END OF SECTION**


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**SECTION 271005**

**HORIZONTAL STRUCTURED CABLING SYSTEM FOR VOICE AND DATA**

## PART 1 GENERAL

### 1.01 SCOPE

A. Work under this section includes the furnishing and installation of raceway system and complete prewiring of the horizontal system including cables, conduit, jacks and plates as specified herein and as shown on the drawings.

B. Coordinate all work with Owner's IT Department.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260533 - Raceway and Boxes for Electrical Systems

C. Section 262726 – Wiring Devices

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit shop drawings for telephone, jacks and cables and labeling procedure.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Raceway and Boxes for Electrical Systems - Refer to Section 260533.

B. Jacks - Leviton, Systimax, or pre-approved equal.

C. Cable – Mohawk, Superior Essex, or pre-approved equal by Owner.

### 2.02 VOICE/DATA EQUIPMENT

A. Conduit
   1. Conduit shall be minimum 1" and as sized on drawings, type EMT where exposed or concealed in walls and ceilings. Conduits shall be concealed wherever possible. Conduits for individual voice/data outlets shall be installed to the nearest telecommunication board.

B. Outlet Boxes
   1. Outlet boxes shall be 4 inch square, 2-1/2 deep galvanized steel with 2 gang mud ring.

C. Jacks
   1. Voice/Data activated outlets shall be equipped with flush mounted 4 terminal jacks,


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assembly as required. All unactivated outlets shall be equipped with stainless steel blank plates to match specified wiring device plates.
2. Jacks shall be mounted in a 106-type frame, a mounting frame Leviton 41087 QP.
3. Jacks shall be Category 5e, Leviton #5G110-R05 (orange), Systimax #108232703 (orange).
4. Coverplate shall be Type 302 stainless steel.
5. Provide (3) three Category 5e cables to each outlet unless noted otherwise on drawings. Contractor shall coordinate with Owner.
6. Device color and plate shall match receptacles and switches.

D. Cables
1. Voice/data cables shall be Category 5e, 24 gauge solid copper, unshielded, 4 twisted pair, (UTP) blue.
2. Mohawk #M56168B or Superior Essex #52-241-28 plenum rated.
3. Conductors shall be twisted to form pairs and fully color coded. Conductors twist shall be of varying lay lengths to eliminate crosstalk.
4. All conductors shall be continuous and splice free.
5. Cables shall be U.L. listed, comply with Article 800 of the NEC, and meet the requirements of UL 444 and ICEA. Cables shall meet the physical and electrical requirements of 100 OHM "Backbone Cable" as defined by EIA/TIA-568 standard for commercial building wire.

E. Voice/Data Jack Identification
1. Each jack shall be labeled. The labeling follows a standard format, indicating the room followed by the location within the room as follows:

AA-BBB-CC-DDDDD-EE

A - 2 characters
B - 5 characters
C - 2 characters

'A' characters are the floor the outlet is on.

- OF – Office Area
- WH – Warehouse Area
- MZ – Mezzanine

'B' characters are the room identifier. These characters indicate the room number that the jack is located within. These should always be characters in length.

O's shall be used as fillers. Coordinate with Owner. See variations to room numbers below:

- OS – Outside of Room XXX, OSXXX.
- OC – Cubicle Area in Room XXX, OCXXX
- HL or OH – Hallway near Room XXX, HLXXX.

'C' characters are the specific jack identifier. These two characters specifically identify a jack within a room. The jack labeling scheme begins with AA, incrementing to AB, etc.


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giving each jack in the room its own identification.

2. Labels shall be self-adhesive type that is approved by Owner. Labels shall be typed printed and shall not be drawn by hand.

3. As-built drawings shall identify voice/data jack numbers for each outlet.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. All cable shall be installed in conduit unless approved otherwise by Owner.

B. The installation shall follow the following standards:

| | | |
|---|---|---|
| 1. | TIA/EIA-568-A | Commercial Building Telecommunications Cabling Standard |
| 2. | TIA/EIA-568-A-1 | Propagation Delay and Delay Skew Specs for 100Ω 4-pair Cable |
| 3. | TIA/EIA-568 | Category 5E standards |
| 4. | TIA/EIA-569-B | Commercial Building Standard for Telecom. Pathways and Spaces |
| 5. | TIA/EIA-TSB 72 | Centralized Optical Fiber Cabling Guidelines |
| 6. | TIA/EIA-TSB 75 | Additional Horizontal Cabling Practices for Open Offices |
| 7. | TIA/EIA-TSB 95 | Additional Transmission Performance Guidelines for 4-pair 100Ω Category 5E Cable |
| 8. | TIA/EIA-606 | Administration Standard for the Telecommunications Infrastructure of Commercial Buildings |
| 9. | TIA/EIA-607 | Commercial Building Grounding/Bonding Requirements |
| 10. | NFPA 70 | National Electric Code (NEC) (esp. Art 800 and Art 770) |
| 11. | ISO/IEC 11801 | Generic Cabling for Customer Premises |

The most recent versions of all documents apply to this project.
If there is a conflict between applicable documents, the order above shall dictate the order of precedence in resolving the issue unless an enforceable local or national code is in effect.

C. The voice/data system shall be completely prewired by the Electrical Contractor including individual outlet jack and plate assemblies. Phones and telephone distribution or switching equipment will be provided by the Owner. Termination at switching equipment will be by owner.

D. Voice/data cables installed in air plenum ceiling spaces without conduit shall be special fire/smoke resistive type approved by the local inspection authority.

E. Provide all sleeves necessary for telephone system installation. All openings in firewalls and floors for telephone cables shall be filled by this contractor after cables are installed with fire-retardant material. Refer to Section 260533 - Article 3.01 - B.

F. All empty conduits furnished and installed by this Contractor for the voice/data system shall


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have a pull wire in place.

**3.02 CABLE INSTALLATION**

A. All cables, termination components and support hardware shall be furnished, tested, installed and wired by the Contractor.

B. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

C. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions shall not be exceeded.

D. Manufacturers minimum bend radius specifications shall followed in handling, installation and securing of all cables. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

E. All cables shall be installed splice-free.

F. Cable sheaths shall be protected from damage from sharp edges during and after installation. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

G. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.

H. Contractor is responsible for verifying cabling requirements prior to construction to insure that the installation is compliant with all code restrictions.

I. All openings made to accommodate the installation of any cable shall be sleeved and fire-stopped per prevailing code requirements upon completion of cable installation.

J. Installation of cables shall use a turning radius of 10 times the diameter of the cable.

K. Cable pulling shall be done in accordance with cable manufacturer’s recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions shall not be exceeded.

L. Data termination hardware shall meet full Category 5E performance specifications as defined by TSB-40A specifications for connecting hardware.

**3.03 CABLE TESTING**

A. Test shall be conducted in accordance with TIA 568C.

B. Any cable that fails these tests shall be re-terminated and tested again. If the cable does not meet specifications after being re-terminated, replace cable, terminate, and test again.

C. The test results for each link shall be recorded in the memory of the field tester upon completion of the test.

D. The test results saved by the tester shall be transferred to a CD-ROM. A guarantee shall be


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provided that the results of the measurement shall be transferred to the CD-ROM unaltered – that is, as saved by the tester at the end of each test. The guarantee shall also specify that the results cannot be modified at a later date.

E. The test results for the completed project shall be stored and delivered to Owner on a CD-ROM, along with the software tools required to view, inspect, and print any section of the test reports.

**END OF SECTION**


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**SECTION 275133**

**CABLE TELEVISION SYSTEM**

## PART 1 GENERAL

### 1.01 SCOPE

A. The work to be provided under these specifications consists of furnishing and installing complete and operable Satellite or cable distribution systems as indicated on the electrical riser diagram.

B. Installation shall be performed by or under the supervision of a factory authorized organization.

C. Be prepared to provide inspection and service to the system, including replacement parts and to offer a service contract for maintenance of the system after the guarantee period.

D. Provide all labor, materials, equipment and services and perform all operations required for complete installation of CATV system and related work as shown on the drawings and specified herein.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B Section 260519 - Low Voltage Electrical Power Conductors for Cables (600 Volts and Below)

C. Section 260533 - Raceway and Boxes for Electrical Systems

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submittal contents: Engineering drawings of the system with specification sheets covering all component parts. Include a riser diagram that shows pertinent signal levels throughout the system. The system and equipment as shown in the engineering drawings and specification sheets shall comply with all parts of this specification.
   3. After completion of the work under this contract, furnish one set of operating instructions, including circuit diagrams and other information necessary for proper operation, and maintenance of system components.
   4. Supply one complete set of as-built drawings of the system. Include all pertinent signal levels throughout the system as they were at the system acceptance date.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. Cable - Baron, Belden, Carol, King, Mohawk, Weico.


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**2.02 PERFORMANCE**

A. These specifications are based on equipment from Jerrold and RCA to set a standard for design and quality.

B. System design minimums: 43 dB carrier-to-noise ratio and -46 dB cross-modulation level at output of the last amplifier in the distribution system.

C. Provide outlets, located as shown on the drawings, with minimum signal levels as follows:

+ 0 dBmV, VHF-TV, channels 2 - 13

D. Signal levels shall not exceed + 15 dBmV at any outlet. Make all measurements across 75 ohms.

E. Design system such that connection to cable television will require only reconnection of unit cable from MATV patch panel to cable TV patch panel. Include UHF to VHF convertor for reception of UHF signals.

F. System radiation limits:

5 MHz to 54 MHz 15 uV/meter @ 100 ft.
54 MHz to 2l6 MHz 20 uV/meter @ 10 ft.
216 MHz to 400 MHz 15 uV/meter @ 100 ft.

G. Equipment designed and rated for 117V, 60 Hz, AC operation and UL listed.

**2.03 EQUIPMENT**

A. Satellite Dish or Cable Connection
1. Provide satellite dish or connection to cable company as determined by building location.

B. Amplifiers
1. Minimum full gain of 44 dB with a maximum output capability of +52 dBmV for each of 9 channels with less than -46 dB cross-modulation on any channel. Equip with separate built-in automatic overload control circuits for low band and high band. Full composite output levels controlled automatically □ .5 dB for input variations of +dB. Separate controls for low band and high band provide a level setting range of 20 dB min. A tunable FM trap provided with a notch depth of at least 10 dB, Jerrold Model 3662.
2. VHF broadband amplifiers shall be installed in the system as specified. The amplifiers shall have a minimum full gain of 30 dB with a maximum output capability of +45 dBmV for 7 channels with less than -46 dB cross-modulation on any channel. Input and output impedance shall be 75 ohms with a return loss of 10 Db minimum. Noise figure at full gain shall be 8.5 dB or better. Separate gain controls with a range of 10 dB shall be provided for low and high band. Frequency response shall be 54 MHz to 108 MHz and 174 MHz to 216 MHz with a flatness of □ 10 dB. A tunable FM trap shall be provided with a notch depth of at least 10 dB. The unit shall be powered from 117 VAC and shall be UL listed. Jerrold Model 3455.

C. Broadband mixing/splitting devices: Install in a rugged cast aluminum housing equipped with flanges to permit mounting on any flat surface. Units shall meet FCC specifications on radiation. All unit frequency response from 5 MHz to 300 MHz or from 5 MHz to 806 MHz. Two-way splitters: Maximum splitting loss of 3.8 dB. Four-way splitters: Maximum splitting


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loss of 8.4 dB. Jerrold Models 1596B, 1957A.

D. Directional Coupler Multi-Tap:
   1. Four-way directional coupler type taps for signal distribution fully shielded and in compliance with FCC rules pertaining to radiation. Connect to unit with standard type "F" conductors. Taps available in isolation values of 10, 14, 19, 24 and 30 dB. Frequency response of models from 5 MHz to 806 MHz. Return loss at any port not less than 14 dB. Isolation between any two tap outlets not less than 30 dB from 5 MHz to 400 MHz and not less than 15 dB from 470 MHz to 806 MHz.

      Jerrold Model DCT-4 Multitap

   2. Mount directional couplers on DCT-MP mounting plates adjacent to the equipment housing.

E. Directional coupler type taps: Provide as required for signal distribution fully shielded and in compliance with FCC rules pertaining to radiation. Taps available in isolation values of 7, 13, 19, 25 and 31 dB. Frequency response through any port from 5 MHz to 805 MHz except the tap with the lowest isolation. This tap (7 dB isolation) shall have a frequency response from 5 MHz to 300 MHz. Provide a single RF outlet with a type "F" connector. Through match l8 dB minimum and back match in excess of 14 dB. Any combination of taps shall provide a minimum isolation between tap ports of 30 dB. Through connection to tap made by standard type "F" fittings. Tap housed in rugged cast aluminum case and capable of mounting in a standard electrical wall outlet box.

   Jerrold Model DFT- Taps

F. Terminating resistors: 75 ohm impedance installed at unused ports and feeder line ends. Terminating resistors at unused ports and feeder line ends. Terminating resistors designed to cover the frequency range from 5 MHz to 890 MHz with minimum return loss of 25 dB at UHF and 30 dB across the VHF band.

   Jerrold Model TR-75F - "F" connector.
   Jerrold Model TR-72B - B-59 housing.
   Jerrold Model TR-75FCW - "F" power blocking.
   Jerrold Model STR-75D - VSF port.

G. Coaxial cable: 75-ohm impedance, return loss of 20 dB minimum from 7 MHz to 806 MHz. Copper-clad steel center conductor and cellular polyethylene dielectric with two shields. First shield of .022 inch double aluminum coated mylar or polypropylene tape with 1/8 inch overlap. Second shield 90% coverage aluminum braid consisting of 34 AWG wire. Outer jacket of black non-contaminating low temperature polyvinyl chloride. RG-6 cable nominal loss per 100 feet of 0.57 dB at 7 MHz, l.6 dB at 54 MHz, 3.2 dB at 2l6 MHz, 4.5 dB at 470 MHz and 6.6 dB at 890 MHz. Center conductor No. l8 AWG with a dielectric O.D. of 0.l85 inches. Cable O.D. shall be 0.285 inches. Individual drain wires, in lieu of braid are not acceptable.

H. Coaxial cable connectors: Solderless, 75 - ohm impedance designed for the specific type of cable used. Splices in coaxial cables are not acceptable. Connectors for aluminum cable of radiation-proof design equipped with integral compression sleeves for long-term radiation shielding. Following connectors are acceptable:
   Jerrold Models F-56, F-56A, SF-56.

I. Equipment housing: Provide as required to protect and install equipment. Manufacture from


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heavy gauge steel finished in silver gray hammertone. Removable cover equipped with a louvered metal front for ventilation, handles for removal and provisions for locking the housing with a padlock. Provide 28 inch vertical space for mounting standard 19 inch rack width equipment. Mounting rails drilled and tapped in a position to provide five inches of front and rear clearance for equipment. Provide knock-outs for power entrance and coaxial cables.

Jerrold Model EH-40.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Conform to the National Electrical Code and applicable local codes. Ground electronic equipment, satellite dish and supports using a No. 6 solid copper wire. Connect to the building service ground.

B. Support cable adequately. Use connectors specifically designed for the type cable in use. Cables may be installed without conduit in hollow walls and accessible ceilings. Provide approved plenum cable or use conduit in air plenum ceiling spaces.

C. Amplifier input and output cables shall not be bundled. Maintain physical separation between input and output cables as much as practical.

D. Fasten equipment with in-line pads mounted in cabinets or other solid support. Equipment suspended by its coaxial connection is not acceptable.

E. Antennas: Support with heavy gauge steel mast or towers and appropriate guying as required. Make no attachment to cornices or copings. Penetrations through roof surface shall be sealed according to accepted building methods.

F. Outdoor connections: Weatherproof through the use of weather boots or other approved method. Suitably support and secure cables from the antennas to the headend.

G. The supplier shall be an authorized dealer for the type TV camera specified, be experienced in CCTV systems and be able to service the equipment locally.

H. Install equipment in strict accordance with manufacturer's recommendations and instructions. Equipment shall be installed in a standard 19 inch rack, floor mounted.

### 3.02 TEST AND BALANCING

A. Upon completion perform the necessary adjustments and balancing of all signals and amplifier level controls to insure proper system operation.

B. Physically inspect system to assure that all equipment is installed in a neat and workmanlike manner as called for by the plans and specifications.

C. Conduct an operating test for approval. System shall be demonstrated to operate in accordance with the requirements of these specifications. Perform test in the presence of an authorized representative of the owner. Furnish all equipment and personnel required for tests.

D. Should demonstration of performance show that the system has not been properly balanced


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or picture degradation is present or output is not as specified, make all necessary changes or adjustments and perform a second demonstration. Should a second performance demonstration fail, correct the system deficiencies under the supervision of the owner's technical staff at no cost to the Owner.

E. Be responsible for a complete and fully operable television distribution system. Make necessary system calculations to assure a trouble free state-of-the-art installation. Include these system calculations with shop drawings and maintenance manuals. Furnish additional or superior amplifiers, splitters, couplers and other system components to attain the requirements indicated.

F. As it is not practical to enumerate all details of fittings and accessory equipment required for proper operation of the system herein described, it is understood that they will be supplied without additional cost to the owner.

G. All fittings, pads, terminations, filters, wave traps, etc. needed to provide the best performance possible shall be provided.

**3.03 TEST METHOD AND PROCEDURE**

A. System balance test: Use a Jerrold Model 727 Field Strength Meter or equivalent at the combined output of the headend system. Measure the level of each channel's picture and sound carrier and record.
   1. Measured levels shall be within □ 3 dB from design levels specified. Levels measured shall not exceed the maximum output rating of the headend amplifier employed.
   2. The level difference between channel picture carriers shall not exceed 2 dB for adjacent channels nor 12 dB between the strongest and weakest channel normally carried.
   3. In systems carrying adjacent channels Note: Channel 4 and 5 or 6 and 7 are not considered to be adjacent. The picture carrier to sound carrier level ratio of any lower adjacent carrier shall be not less than 12 dB nor more than 18 dB.
   4. Test systems containing individual channel strip amplifiers with AGC for AGC operation. The measured field strength level at the output of each AGC type amplifier shall not vary more than □ 0.5 dB with the insertion of 6 dB of attenuation in the amplifier input signal.

B. The following proof of performance tests are considered as minimum requirements for all systems regardless of size.
   1. Inspect each cable feeder line for proper termination.
   2. Using a field strength meter, measure the signal level at the last outlet on each feeder line and other randomly selected outlets. The signal level on each channel shall not read less than 0 dBmV, nor more than 15 dBmV, unless specified otherwise.
   3. Using a standard TV receiver connected to randomly selected outlets, not less than one per feeder, observe picture quality. No visible components of cross-modulation, "wind-shield wiper effect", ghosting or beat interference shall appear on the screen of a receiver tuned to any normal signal.

C. For large systems containing one or more amplifiers after the initial headend, the following additional tests are required.
   1. Carrier-to-noise test: Use a Jerrold Model 727 Field Strength Meter or equivalent at the output of the last amplifier in the system. With the normal levels in the system tune the field strength meter to the picture carrier of each channel in turn and not the reading obtained on the meter. The signal shall then be removed and the input to the headend amplifier terminated in 75 ohms. Read the level of remaining noise in the absence of the signal and add a meter bandwidth correction factor of 4 dB to the reading. The difference


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between the two readings will give the system's signal-to-noise ratio. Minimum of 43 dB, unless otherwise specified.

2. Cross-modulation tests: Using a standard TV receiver and an RF carrier generator. Insert an unmodulated CW carrier at the system headend, in lieu of one of the channels normally carried by the system. With the TV receiver connected at the most remote outlet in the system and tuned to the CW signal, observe that there are not visible components of cross-modulation "windshield wiper effect". For best results, the artificially generated blank channel should originate with a crystal controlled modulator that is driven by a closed circuit camera with the lens capped to produce sync only for the benefit of the test TV receiver.
3. After the equipment has been installed and is in operating condition, instruct personnel of the Owner on the operation of all aspects of the system. Supply two sets of wiring diagrams and two copies of repair manuals for each of the components of the system.

**3.04 STANDARDS**

A. Provide U.L. listed and labeled equipment for which there are Underwriter's Laboratories Standard requirements. All basic equipment exclusive of cable shall be the latest product of a manufacturer of established reputation and experience in engineering achievement and development of quality electronic equipment. All equipment shall be new materials.

**END OF SECTION**


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**SECTION 282330**

**VIDEO SURVEILLANCE SYSTEM**

## PART 1 GENERAL

### 1.01 SCOPE

A. Work under this section includes the equipment, wiring and complete installations for the video surveillance system indicated and specified herein.

B. Provide a complete closed circuit TV system capable of high quality, reliable and satisfactory operation as shown on the drawings and detailed in the specifications. Provide conduit and wiring for the system.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600 Volts and Below)

C. Section 260533 - Raceway and Boxes for Electrical Systems

D. Section 275133 - Cable Television System

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit shop drawings for all cameras, monitors, enclosures, sequential switches, cables and other devices specified in this section. Provide complete point-to-point wiring diagram showing all devices and wiring for this project.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. RCA, Sanyo, Panasonic and General Electric

### 2.02 GENERAL

A. Provide a complete video surveillance system the product of one manufacturer or of an agency experienced in such work. Installation and connection of equipment and tests of the operation of the systems shall be made by a representative of the manufacturer or agency.

B. A control console with monitors and switching control will monitor the building via closed circuit cameras. With the equipment provided, a complete monitoring cycle of the complex shall take less than one minute accomplished in the following manner:
   1. Sequential switches shall sequence video from each camera location to monitors viewed by the operator. Any location may be excluded from the sequential operation. Provide continuously adjustable switching intervals from 1 to 45 seconds. Any camera, at any


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time the operator chooses, may be placed in a "HOLD" position which will display that particular picture on a separate monitor. In the hold position sequencing of other camera pictures continue.

C. Vestibule entry area camera shall be interconnected with the MATV or CABLE TV system to allow any tenant to view the caller.

D. Manufacturer's names used shall establish a standard of design and quality.

**2.03 EQUIPMENT**

A. Cameras - RCA Vidicon #TC7000 Series with minimum features as follows:
1. Provide 8mm, f/1.8, auto iris lens with adjustable f-stop for 2/3" Vidicon applications.
2. Solid-state crystal controlled with 100,000:1 ATC automatic light range.
3. Auto Track Electronic Focus providing sharp electrical focus throughout life of tube.
4. Signal to Noise-Better than 44 dB.
5. Automatic Beam Control, ABC, automatic circuitry eliminates need of periodic adjustment of beam throughout life of camera tube.
6. White Clipper - automatically keeps highlights within preset level to avoid monitor or VTR overdrive.
7. Auto Black - maintains constant pedestal setup throughout entire light range.
8. Geometric Distortion - 1.5% maximum of picture height within a center circle with diameter equal to picture height. 2% overall.
9. Provide cameras for operation at 24 VAC and central 24 VAC power supply located with monitoring equipment.

B. Camera Mounts - RCA #V100AWM
1. Adjustable wall mount type for interior locations.

C. Camera Enclosures - RCA #V8600H
1. Provide at interior camera locations.

D. Sequential Switches - RCA #V150LBS
1. Ten multi-position vertical interval sequencing series looping, bridging switchers. Monitor shall display the sequencing cameras or the sequence may be stopped for display of any camera location. Provide desk top style with power cord.
2. Provide rack mount style to recess into custom made console when required. Coordinate with millwork and architectural when recessed.

E. Monitors - RCA #TC1910 Alpha
1. 9" diagonal monochrome of solid-state construction with 700 line resolution, up front rotary operating controls, 13 KV high voltage, regulated power supply and automatic frequency control, AFC. Provide complete with enclosure and power cord.
2. Provide rack mount style to recess in custom made console when required. Coordinate with millwork and architectural when recessed.

F. RF Modulator Connector
1. Provided with the MATV or cable system to display residential entry camera(s). Coordinate feature with the MATV or cable system installer for verification of operation.

G. Cable Connectors - Amp 2-329064-1 BNC
1. Provide quick crimp type. Coax lines shall not be soldered.


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H. Coax Signal Cables - RG59U, Belden #8241.
   1. Provide with copper center and copper braid.

## PART 3 EXECUTION

### 3.01 WIRING

A. Install in conduit in accordance with manufacturer's direction.

B. Contractor shall coordinate all video surveillance equipment requirements and installation requirements with video surveillance vender.

### 3.02 INSTALLATION

A. Install protective housing for cameras on mounts adjustable from a level position to a straight down position, 90 degrees and 360 degrees in the horizontal plane.

B. The supplier shall be an authorized dealer for the type of TV camera specified, be experienced in CCTV systems and able to service the equipment

C. Install equipment in strict accordance with manufacturer's recommendations and instructions. All equipment shall be capable of rack mounting.

D. Provide preassembled and prewired components such that only connections to building wiring systems need to be at the site.

E. After the equipment has been installed and tested is in operating condition, instruct personnel of the Owner on the operation of all aspects of the system. Supply wiring diagrams and copies of repair manuals for each of the components of the system.

F. Coordinate location of monitors with owner, and provide all necessary mounting equipment.

**END OF SECTION**


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**SECTION 283101**

**FIRE DETECTION AND ALARM**

## PART 1 GENERAL

### 1.01 SCOPE

A. Work under this section includes the equipment, wiring and complete installation for the addressable, intelligent microprocessor based fire alarm and detection system with addressable devices indicated and specified herein.

### 1.02 RELATED SECTIONS

A. Section 260500 - General Requirements

B. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600V and Below)

C. Section 260533 - Raceway and Boxes for Electrical Systems

D. Division 14 - Conveying Equipment

E. Division 21 - Fire Suppression

F. Division 23 - Heating, Ventilation and Air Conditioning

### 1.03 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit shop drawings for all fire alarm and detection devices, control panels, relays, all panel module devices and all other equipment specified in this section. Provide a point-to-point wiring diagram specifically for this project with all devices shown with proper wire counts, annunciation, power connections, battery calculations, wire types and sizes.
   3. Submit names and credentials of NICET installers to be assigned to this project.
   4. Submit duct detector manometer test report.
   5. Submit as required to local authority having jurisdiction (AHJ) for fire permit application.
   6. Upon completion of project, submit U.L. Central Station Fire Alarm System Certificate, fire alarm certification complying with NFPA 72 Record of Completion, NFPA 72 Test and Inspection Form and any local authority requirements.
   7. Red fire alarm conduit EMT, Allied Tube and Conduit or equal.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

A. EST EST3, FCI, Gamewell, Notifier, Siemens Cerberus, Simplex Grinnell.

B. The equipment manufacturer shall have a local branch office staffed with factory trained, full-time employed personnel who are capable of performing tests, inspection, repair and


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maintenance services for the expected life of the fire alarm system and are licensed by the State Board of Electricity.

C. Installation of the fire alarm system shall be by a National Institute of Certification of Engineering Technology (NICET) Level 2 certified installer with a NICET Level 3 foreman reviewing the installation of the rough-in and during final testing.

## 2.02 GENERAL

A. The Contractor shall furnish, install and place in operating condition a microprocessor based, addressable, intelligent fully field programmable fire alarm system with addressable devices. All units of equipment shall be listed by Underwriters Laboratories (U. L.) per NFPA 71 and 72 for fire alarm signaling use and shall consist of a control unit, alarm initiating devices, alarm indicating devices and auxiliary control devices as required, specified herein, or shown on drawings, and wired in accordance with the manufacturer's instructions to make a complete and workable system as hereinafter described.

B. The fire alarm control panel shall provide an automatic smoke and temperature sensor sensitivity self-test once per minute and shall comply with NFPA 72 requirements for a test of sensitivity ranges.

C. An open, short or ground condition of any Signaling Line Circuit (SLC), Initiating Device Circuit (IDC), or Notification Appliance Circuit (NAC) or loss of battery standby or normal AC power shall cause an audible trouble signal to sound and a warning light to come on at the control panel, and the event to be recorded into the historical log. The trouble light shall stay on until the trouble condition is corrected and the trouble silence switch is manually reset at the control panel.

D. The system shall operate on and be supervised by 24 VDC power, separately fused at the control panel.

E. Wiring style type shall be as follows:
   1. Addressable Signaling Line Circuits (SLC) shall be style 4 (Class B).
   2. Initiating Device Circuits (IDC) shall be style B (2 wire).
   3. Notification Appliance Circuits (NAC) shall be style Y (2 wire).

F. Fire alarm wire shall be as follows:
   1. Fire alarm system wire type and sizing as recommended by the manufacturer.
   2. MC type fire alarm cabling is not allowed.

## 2.03 FIRE ALARM PANEL

A. The control panel shall be equal to a Simplex Grinnell 4100 Series Truealarm Addressable. Locate as indicated on drawings, however verify acceptability of location with local authorities prior to installation.
   1. The control panel shall be metal, and contained in a single surface mounted cabinet, complete with hinged door, lock and key.
   2. The panel shall contain an 80 character liquid crystal display. Switches for: fire alarm acknowledge, priority 2 alarm acknowledge, supervisory acknowledge, system trouble acknowledge, alarm silence, and system reset. LED indicators for: fire alarm, priority 2 alarm, system supervisory, system trouble, signals silenced, and AC power-on. All necessary relays, fuses, terminal strips, auxiliary relays, and an internal Central


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Monitoring Station SDACT (Serial Digital Alarm Communicating Transmitter) with bypass switch.

a. SDACT shall be capable of telephone line seizure and shall be connected to two telephone lines.

3. The panel shall include the functions of double supervision complete with audible and visible trouble signals and automatic trouble reset. The operation of the trouble signal shall be different from the alarm signal.
4. The main control panel shall be microprocessor based and shall allow custom field programming to meet specific application and code requirements.
5. All switches, lamps and terminals shall be labeled in a permanent legible manner.
6. Fire alarm control cabinet shall have integral battery backup with charger and shall provide complete battery supervision. Provide [4] [**24**] [90] hour battery backup with [**5**] [15] minutes of alarm at the end of the standby period.
7. Auxiliary relays shall be provided within the panel for 24 VDC [VAC] door holder circuits.
   a. Power door holders from fire alarm system and size power supply to maintain door holder operation in the event of a power failure for 30 seconds.
8. All programming functions shall be contained in non-volatile memory.
9. Provide NAC as required by quantity of devices with no circuit exceeding 75% of its capacity. Provide separate circuits for audible and for visible devices.
10. Provide IDC as required by quantity of devices with no circuit exceeding 75% of its capacity.
11. Provide SLC as required by quantity of devices with no circuit exceeding 75% of its capacity.

Panel shall contain a 600 event historical log. Trouble events shall not overwrite alarm events.

## 2.04 INITIATING APPLIANCES

A. Manual Pull Stations: Addressable, semi-flush, single action operation with breakrod feature. Station shall be designed so that once operated, it must be key opened to be restored to normal. Stations shall have reset locks of tumbler type keyed alike to control panels. Key shall be used to operate station for drill or test.

1. Provide weatherproof stations in pool, and wet or exterior locations.

B. Thermal Sensors: Thermal sensor shall be self-restoring, rate compensated, fixed temperature sensing, selectable with or without rate-of-rise sensing, complete with intelligent addressable base. Rate-of-rise detection shall be selectable for either 15 degrees F, or 20 degrees F per minute. Fixed temperature sensing is independent of rate-of-rise sensing, and programmable to operate at 135 degrees F, or 155 degrees F. Sensors may be programmed as a utility device to monitor for temperature extremes from 32 degrees F to 155 degrees F such as freeze warnings or to alert for utility problems. Provide 135 degrees F fixed temperature heat sensor in elevator shaft/equipment rooms. Heat sensors located in an area where automatic sprinkler heads are installed shall have a lower temperature rating of 30 degrees F less than the sprinkler head temperature rating in that area. Provide 200 degrees F fixed temperature heat detector with addressable monitor module in mechanical room/high temperature areas. Address setting shall be in sensor base to facilitate sensor exchanges without reprogramming.

C. Area Smoke Sensors: Photoelectric, smoke density measuring sensor, environmentally self-compensating, with intelligent addressable base. The sensor shall be interchangeable with ionization, or thermal sensors using the same base type. Their light source shall be a pulsed


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infrared LED. Internal detector circuits shall be shielded against electrical interference and shall be resistant to transients, "noise" and RF interference. Smoke sensors shall be able to be field tested without the use of real or artificial smoke. The sensitivity for each sensor shall be field selectable in seven settings from 0.2% - 3.7% per foot smoke obscuration from the control panel. Smoke sensor shall display “dirty detector” at the control panel without reducing sensitivity. The control panel shall provide automatic, once per minute, individual sensor sensitivity test with peak value reporting. Address setting shall be located in the base to facilitate sensor exchange without system reprogramming.

1. Area smoke detectors in guestrooms shall be wired to alarm at main FACP only, and will not set off building wide alarms.

D. Duct Smoke Sensor Housings: Intelligent addressable photoelectric smoke sensors.
   1. Duct housing shall contain the same type photoelectric sensor as the area smoke sensors.
   2. Provide an addressable control module at each motor controller for AHU shut down.
   3. Provide a remote alarm indicator/test switch at a visible/accessible location adjacent to sensor, or on wall directly below unit, and provide label indicating the AHU served by duct sensor.
   4. Duct sensor shall receive operating power from fire alarm control panel.
   5. Duct sensor shall be reset at the fire alarm control panel or annunciators.

E. Sprinkler Flow, Gate Valves, High/Low Pressure Switches and Post Indicating Valve: Flow switches and gate valves shall be furnished under the mechanical contract. These units shall have contacts suitable for use with fire alarm systems. Provide addressable monitor modules for each switch.

F. Auxiliary Relays: Provide addressable control modules to shut down HVAC units and close fire/smoke dampers any time fire alarm system is in alarm mode. Locate addressable control modules within three feet of damper motors, motor starters, and other equipment being controlled per NFPA 72.

G. Guestroom Area Smoke detectors: Photoelectric, smoke density measuring sensor, environmentally self-compensating, with intelligent addressable base. Detector shall come with sounder base to allow local audible and visual alarm within room to notify guests. Their light source shall be a pulsed infrared LED. Internal detector circuits shall be shielded against electrical interference and shall be resistant to transients, "noise" and RF interference. Smoke sensors shall be able to be field tested without the use of real or artificial smoke. The sensitivity for each sensor shall be field selectable in seven settings from 0.2% - 3.7% per foot smoke obscuration from the control panel. Smoke sensor shall display “dirty detector” at the control panel without reducing sensitivity. The control panel shall provide automatic, once per minute, individual sensor sensitivity test with peak value reporting. Address setting shall be located in the base to facilitate sensor exchange without system reprogramming. Area smoke detectors in guestrooms shall be wired to alarm at main FACP only, and will not set off building wide alarms. Detector shall be capable of wall mounting.

H. Carbon Monoxide detector: Electro-chemical CO detection, suitable for ceiling or wall mounting. Dual LEDs for local status indication, green LED for normal operation, red LED flashes ii temporal 4 pattern to indicate alarm. Detectors shall be located no more than 10 feet form guestroom doors. Detector when in alarm shall generate from the panel a distinct audible alarm different from smoke alarm.


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I. Elevator Recall: Provide addressable control modules in elevator equipment room and control wiring from modules to elevator controls for elevator fire alarm operation control. Program fire alarm system to provide signals to elevator controller per NFPA 72 requirements, and as required by local AHJ. Locate modules within three feet of controller per NFPA 72.

J. Elevator Power Shunt-Trip: Provide elevator shunt trip wherever elevator shafts or machine rooms are sprinklered. Provide addressable control module adjacent to shunt trip breaker and provide control wiring to breaker. Program fire alarm system to provide signal to activate shunt trip breaker upon activation of heat detectors in elevator shaft/equipment room per NFPA 72 requirements. Locate modules within three feet of Shunt-Trip per NFPA 72 requirements. Provide a voltage monitoring relay to monitor the pressure of the shunt trip voltage. This relay shall be placed in parallel to the shunt trip coil. If at any time voltage is not present, a trouble alarm shall annunciate at the fire alarm control panel and at any annunciator panels (if present). Panel to annunciate “loss of elevator shunt trip power”. Locate within 3’0” of the shunt trip breaker per NFPA requirements. For hydraulic elevators with battery supplied emergency lowering capabilities, provide auxiliary contact in shunt trip breaker and control wiring to elevator controller. Wiring from breaker to provide signal to elevator controller when power is disconnected to prevent false lowering of elevator during maintenance. Coordinate wiring with elevator supplier.

## 2.05 NOTIFICATION APPLIANCES

A. Audible-Visible: Interior general alarm notification signals shall be combination horn/strobes. Visible portion will be 1 Hz synchronous xenon strobes with clear lens and red fire lettering. Horn/strobes shall be wall mounted where shown on drawings. 24 VDC Horn output shall provide 93 dBA at 10 feet with a modulated frequency output of 2400 to 3700 Hz sweep. Strobes must meet ADAAG, NFPA 72, and ANSI 117.1 requirements for spacing and effective intensity.

1. Provide high humidity strobes in pool areas.

B. Visible Only: Interior general alarm notification signals will be 1 HZ synchronous xenon strobes with clear lens and fire lettering. Strobes shall be wall, or ceiling mounted where shown on drawings. Strobes must meet NFPA 72, requirements for spacing and effective intensity.

1. Provide high humidity strobes in pool areas.

C. Weatherproof Exterior Sprinkler Horn and Light: Furnished and installed as part of this specification. Connect via contacts on addressable control module and 24VDC powered from the fire alarm control panel. Exterior alarm shall be capable of being disabled through the fire alarm system control panel. Provide required software programming. This requirement needs to be verified with the local AHJ.

D. Door Holders: Semi-flush wall mounted on a single gang box with stainless steel armature as required by door. Door holders to be 24 VDC operation powered from fire alarm panel. Provide a minimum 25% spare capacity per each door holder circuit.
1. Zone door holder circuits as one zone per floor.

E. Remote LCD Annunciators: Flush mounted. Located where indicated on drawings.
1. 80 character back lit alpha numeric liquid crystal display unit.
2. Selectable “Enable” Key Switch to activate all switch functions.


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3. All status LEDs, switches, and audible sounder identical to FACP.
4. Reset and Silence capabilities.
5. Four programmable control switches with associated LEDs.
6. Keyboard.

**2.06 REMOTE NAC (SIGNAL EXPANSION) POWER SUPPLIES**

A. Remote NAC power supplies may be used at manufacturer option but must comply with the following:
   1. Locate NAC power supplies in electrical closets only.
   2. 120 VAC Power connection to dedicated circuit breakers from the emergency power panelboards, wire and conduit are to be included with in bid.
   3. Locate an area smoke sensor in room where NAC power supply is located per NFPA 72, 1-5.6 requirements.
   4. Each NAC circuit shall not exceed 75% of its rated capacity.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install all fire alarm system wiring in conduit as recommended by the manufacturer. Fire alarm conduit shall have a bright red top coating (factory applied) to provide distinct identification of fire alarm circuitry.

B. Paint all fire alarm junction box covers red in color and label “Fire Alarm”.

C. All wiring shall be verified as to size and number of conductors with the manufacturer. All wiring shall be color coded, type and size as recommended by the manufacturer and as required by NFPA 72 and NEC 70 (National Electric Code).

D. Fire alarm conductor termination’s in control panel and annunciator panels to be made on terminal strips with separate point for each conductor. All such strips to be number identified as shown in wiring diagram attached to inside of door of control panel. Connect wiring neatly to terminal strips. Connect or clip with nylon cable straps. Set up termination of cabling so that sections of the system may be isolated or shorted out for servicing.

E. Wiring diagram submitted with fire alarm shop drawings shall be full system point-to-point, with address point numbers, with all connections shown.

F. From control modules provide connection to motor controllers and related equipment for fan system control and damper control. Provide control modules at EP switches for each damper control. Provide control wiring from control modules to damper motors. Coordinate with Division 15 for proper operation and EP switch locations. Provide 120 volt power to each smoke damper from a dedicated circuit from each floor connected to a life safety panel or normal panel if life safety is not available. Provide disconnect at each damper motor.

G. From fire alarm control panel provide 3/4” conduit to the telephone MDF (main distribution frame).

H. Provide control wiring to elevator controller for Phase 1 and Phase 2 recall from control modules. Provide control wiring to shunt trip breaker from control module for elevator power disconnect.


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I. Provide connections to all sprinkler waterflow switches, gate valve switches, low pressure switches (flow and low pressure trouble), post indicator valve switch and exterior sprinkler horn/strobes as required to connect to fire alarm system. Refer to Division 21 drawings for device locations and quantities.

J. Provide full width sampling tubes for duct smoke sensors, located to achieve optimum results for sensing smoke in ductwork and readily accessible for testing, observation and maintenance purposes. Test each duct detector with a manometer per NFPA requirements to verify that proper air flow sensing is achieved thru each duct detector per manufacturer's requirements. Submit results with fire alarm certification per NFPA 72. Detectors installed or located improperly shall be reinstalled at Contractor's expense. Coordinate with Sheet Metal Contractor for optimum results.

K. Provide connection to kitchen hood suppression panel, gas valve, and shunt trip breakers. Obtain from food service equipment contractor a wiring diagram for hood, gas valve and shunt trip breaker control and provide any and/or all required wiring, relays, control modules, etc., per that wiring diagram.

L. Provide plastic dust cover over smoke sensor heads for duration of construction. Remove covers at time of final acceptance testing of system and turn over to the Owner.

M. Provide coordination with all subcontractors for systems that require interface wiring with the fire alarm system. These include, but are not necessarily limited to, temperature control, sprinkler fire protection and energy management systems. The fire alarm wiring diagrams shall include details of this interface wiring to dampers, EP switches, motor starters, etc.

N. Maintain existing fire alarm system operations at all times during the course of the project. At no time shall the fire alarm system be left inoperable.

O. Provide a permanent machine printed label on each addressable device with SLC circuit and device number. Owner’s approval required prior to installation of labels

P. All sensor bases located within 10’ of floor shall have their locking device engaged to prevent unauthorized removal of sensor heads.

**3.02 FIRE ALARM SYSTEM OPERATION**

A. Text display shall comply with the following:
   1. Point labels shall be approved by the owner and local AHJ prior to final programming.
   2. Accessible without the use of security codes.

B. Program the fire alarm system control panel as follows:
   1. Alarm mode: Initiation of fire alarm manual station or automatic actuation of thermal sensor, smoke sensor, sprinkler flow switch, dry system flow, or other approved alarm initiating device shall cause the following:
      a. Alarm lamp illuminated in control panel and annunciator panel along with alphanumeric display of alarm condition and record to historical log.
      b. Audible alarm signal synchronous temporal tone throughout entire building.
      c. Visual alarm signals synchronous 1 Hz flash throughout entire building.
      d. Transmit alarm signals to central monitoring station.
   2. Trouble mode:


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a. Operating power failure, ground faults or opens on SLC, IDC, and NAC circuits or other supervised circuits connected to control panel cause an audible trouble signal and trouble lamp to light, and record to historical log, until circuits are restored to normal.
b. Audible trouble signal capable of being silenced by trouble signal silencing switch, but lamp remains illuminated and alphanumeric display until circuit is returned to normal.
c. Restoring circuits to normal after silencing switch has been operated causes lamp to extinguish and audible signal to resound until silencing switch is returned to normal.
d. Closing of sprinkler tamper switch causes separate supervisory signal.
e. Transmit trouble and supervisory signals to central monitoring station.

3. Additional fire alarm control requirements:
   a. Sprinkler valve and post indicating valves activate fire alarm supervisory signal when operators are off normal position.
   b. Magnetic door holders shall release throughout building on alarm unless scheduled or specified otherwise.
   c. Duct smoke detectors in addition to initiating an alarm at fire alarm panel shall shut down associated fan system and close associated dampers.
   d. Elevator lobby and elevator equipment room smoke detectors initiate elevator recall per ANSI and NFPA requirements.
   e. Elevator shaft and equipment room thermal detectors initiate disconnection of service power to associated elevator equipment per NFPA requirements.
   f. Water Flow switch activation shall cause domestic water valve to close.
4. Central station tie shall be through dual telephone line interface. Coordinate dual telephone lines with owner. Program internal SDACT (Serial Digital Alarm Communicating Transmitter) as directed by owner and as required to provide signals to an approved central station. SDACT shall be UL 864 listed per NFPA 72 for Central Station Service and listed to UL 1459. SDACT shall communicate all addressable point status changes, phone line status, all off-normal information, provide automatic 24 hour test, and power fail report delay. First year monitoring shall be included at no charge during warranty period.

## 3.03 SYSTEM VERIFICATION

A. In the presence of the owner, engineer, or their designated representative, have the fire alarm equipment manufacturer make a thorough inspection and test of the complete fire alarm system including all components such as manual stations, thermal sensors, smoke sensors, monitor and control modules to ensure the following:
   1. Complete functional system test in accordance with NFPA 72 and local AHJ requirements.
   2. Installed in accordance with the functions and performance specified and as shown on drawings.
   3. Installed in accordance with manufacturer's recommendations.
   4. Regulations covering supervision of components are adhered to.
   5. Proper operation of elevator control and elevator disconnection.
   6. Make necessary changes to conform to items 1 through 5 with assistance of the manufacturer.
   7. Provide written certification of completed system to include duct detector manometer test report in compliance with NFPA 72 and local AHJ requirements.
   8. Furnish the services of a factory trained service representative for not less than one 4-hour period for instructing personnel in the operation and maintenance of the system.


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9. Provide one additional system reprogramming at no charge of system nomenclature, sensor sensitivity, and/or system functions if so desired by the owner or local AHJ. Provide owner with a copy of a sensor sensitivity report to include peak value of each sensor. This reprogramming shall occur at any time during the 12 month warranty period.

**3.04 MANUALS**

A. Submit complete operating and maintenance manuals in the format required by Division 1 to include:
   1. "As installed" set of complete wiring diagrams.
   2. Information required to operate the equipment and system.
   3. Information for testing, repair, trouble shooting and recommended maintenance intervals.
   4. Provide a replacement parts list and name and address where available.
   5. “As installed” Bill of materials to include catalog cuts of all components of the fire alarm system and devices, and a system point list to include: device address, custom label, sensitivity setting, and peak value.

**3.05 BRANCH CIRCUIT**

A. Provide handle lock on circuit breaker(s) serving each fire alarm panel and paint circuit breaker handle(s) red. Label circuit breaker number and location inside fire alarm and NAC panels.

**END OF SECTION**


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# 015713 – SOIL EROSION AND SEDIMENT CONTROL

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Erosion Control Measures

B. Velocity and Flow Control Measures

C. Sediment Control Measures

D. Application/Installation of Measures

E. Removal/Replacement of Measures

### 1.02 DESCRIPTION OF WORK

A. Furnish all materials; install, construct, maintain, and remove specified temporary erosion control devices; at locations specified in the contract documents, or where specified by the Engineer. Permanent devices such as rip-rap, sod or grassing are covered in other sections.

B. Complete the required construction work on this project, while minimizing soil erosion and controlling water pollution. Maintain these features as specified and as required by the Mississippi Department of Environmental Quality, from initial construction stages to final completion of the project.

C. Minimizing nonpoint source (NPS) pollution from construction sites through good housekeeping and Best Management Practices (BMPs).

### 1.03 SCHEDULING AND CONFLICTS

A. Implement erosion and sediment control measures as required by each phase of construction.

B. Coordinate construction to minimize damage to erosion and sediment control devices.

### 1.04 SPECIAL REQUIREMENTS

A. Comply with all requirements of local and state and federal agencies, i.e. City, County, MDEQ, & EPA regulations.

B. Protection of Property: Prevent accumulation of soil, sediment, or debris from project site onto adjoining public or private property. Remove any accumulation of soil or debris immediately, and take remedial actions for prevention.

C. Project Staging: Replacing erosion and sediment control practices that are damaged or

removed by the contractor in a manner that is inconsistent with the current project staging or SWPPP is the Contractor's responsibility and will be at the Contractor's expense.

PART 2 – PRODUCTS

2.01 Erosion and sediment control materials and installation methods shall be in accordance with requirements of the latest edition of the Mississippi Standard Specifications for Road and Bridge Construction and the Contract Drawings.

The following items are considered approved best management practices that Contractor may implement to control erosion and sediment. Items shown are not project specific.

2.02 WATTLES

A. Netting: Open weave, degradable netting. Nominal diameter of 9 inches, or as specified.

B. Fill Material: Straw, wood excelsior, coir, or other natural materials approved by the Engineer.

C. Stakes: 1 inch by 1 inch (minimum) wooden stakes, or stakes of equivalent strength a minimum of 24" in length.

2.03 CHECK DAMS

A. Check dams are used to slow the velocity of water thus reducing erosion of the drainage way. Although a check dam will trap small amounts of sediment, it should not be considered as a sediment control device. Maximum drainage area is 10 acres.

B. Materials

1. Contractor shall not use straw bales. The use of straw bales as check dams often involves incorrect placement and thus aggravates erosion problems rather than controlling them.

2. Check dams shall be constructed of stone or logs.

C. Do not use in a stream.

2.04 CONSTRUCTION ROAD

A. The temporary stabilization of construction access roads and parking areas.

B. Purpose is to **r**educe erosion of temporary and permanent roadbeds between the time of initial clearing and grading and final stabilization.

2.05 DIVERSION

A. A temporary ridge and channel of compacted soil.

B. Used to divert runoff coming from offsite areas adjacent to the construction site or divert runoff from sensitive areas, thus decreasing the erosion potential. A diversion can also

be used on a construction site to carry sediment-laden runoff to a sediment trap.

C. Maximum drainage area is 5 acres.

D. Diversions placed at the bottom of very steep slopes may be overwhelmed (overtopped or washed out from flows coming down the slope).

E. Diversions must be on proper grade to ensure water flows in the desired direction. Watch for abrupt changes or reversal of grade as failures will occur in these places.

F. Ensure that equipment operators are informed about diversions. A common reason for failure of diversions is equipment being driven over the diversion.

2.06 LEVEL SPREADER

A. A stable outlet for diversions, which collects runoff and disburses it as sheet flow onto an undisturbed, vegetated area.

B. To collect concentrated runoff, convert it to sheet flow and release it to a stable area at low, non-erosive velocities.

C. Runoff should be relatively sediment free.

D. Drainage area is 5 acres or less.

2.07 SOIL BLANKETS (MULCH, MATS, BINDERS)

A. Apply a protective blanket (usually plant residue) to bare soil where required. Blankets or mats shall be LandLok Turf Reinforcement Mats or approved equal.

B. Protects soil from the force of rain. Protects seeds and soil amendments from being washed away. Aids vegetative growth by conserving moisture, suppressing weeds and insulating the soil and seed from temperature extremes.

C. Mulches can be a source and method of introducing weeds.

D. Too much mulch can suppress growth.

E. Wood chip mulches can tie up nitrogen thus requiring additional fertilizer.

F. Some erosion control blankets degrade after a time and some blankets are permanent. Make sure the correct one is specified for the job.

2.08 TEMPORARY SEEDING

A. Establishing a temporary vegetative cover on disturbed sites by seeding with a fast growing annual grass.

B. Areas that will not receive any construction activity for 7 days are required to be stabilized with temporary seeding within 2 days. Temporary seeding reduces erosion, thus reducing the need for more costly sediment control measures.

C. Temporary seeding provides protection for only one growing season. After that time, more permanent measures should be initiated.

D. Seed is subject to being washed away during establishment period. Contractor is responsible to seed as many times as required due to washing at the Contractor's expense.

E. Be aware that certain annual grasses may still out-compete permanent seeding even after the end of their life expectancy. This will require the residue from the annuals to be disked up and the soil prepared for permanent seeding.

2.09 TREE PRESERVATION

A. Protecting desirable trees from destruction or injury during clearing or other construction activities.

B. To ensure the survival of desirable, existing trees during construction so that they can provide erosion control, stormwater runoff management, improved site aesthetics, and other environmental benefits.

2.10 DUST CONTROL

A. Controlling dust while land-disturbing activities are taking place.

B. To prevent the movement of dust from exposed surfaces, thus preventing or reducing complaints about air quality, health hazards, and reducing vehicle and road maintenance.

C. Contractor may use water or approved additives.

2.11 STORM DRAIN INLET PROTECTION

A. A filter or impounding area around a storm drain inlet.

B. Prevent sediment from construction site from entering an existing storm drain system until disturbed area is permanently stabilized.

C. Ponding will likely occur so ensure that damage will not occur to adjacent areas or structures.

D. Use mulch around structure to reduce the sediment load.

2.12 TEMPORARY SEDIMENT TRAP

A. A small ponding area formed by excavation and/or a low embankment across a drainage-way.

B. To detain sediment-laden runoff long enough for some sediment to settle out.

C. Sediment traps should be in use for 18 months or less.

D. Do not use in a stream.

E. Do not place a drain pipe with the inlet at the bottom of the trap and a silt fence across the inlet or outlet to filter sediment.

2.13 SILT FENCE

A. Material for silt fence shall be type 1 or 2 in accordance with Section 714 of MDOT Standard Specifications.

B. Post shall be metal T-posts, 48” minimum length.

2.14 RIP RAP

A. Rip-rap may be used as a temporary erosion control measure. Installation shall comply with Section 313700. Rocks may be used where permanent rip-rap is called for on the plans as long as they are cleaned to a new condition.

PART 3 – EXECUTION

3.01 INSTALLATION

Installation of all materials shall be in accordance with the requirements of the latest edition of the Mississippi Standard Specifications for Road and Bridge Construction, manufacturer’s recommendations, these specifications and the Contract Drawings.

3.02 WATTLES:

INSTALLATION: Install per manufacturer’s recommendations

MAINTENANCE: Replace when filter capacity has been reduced by 75%. Remove when surrounding area has been stabilized.

3.03 CHECK DAMS

INSTALLATION

A. Check dams should be constructed of stone or logs. Silt fence material may be used for check dams. Note: if using silt fence material be aware that the runoff will flowover not through the material. Ensure that the fabric height is set no higher than 18 inches, the center is lower than the ends, that the bottom of the fabric is trenched in and soil compacted and that splash protection is provided on the downhill side so that the water running over the center doesn’t scour the soil and expose the bottom of the fabric.

B. Make the check dam no more than 2 feet in height.

C. Make the center of the check dam at least 6 inches lower than the outer edges.

D. Cover the swale with the check dam and set the height of the outer edges so that runoff will not flow around either end.

E. Space the check dams so that the center of each check dam is the same elevation as the bottom of the check dam immediately above it.

F. If using logs, use 4-6 inch logs and drive them 18 inches deep. Pile brush on downstream side in order to prevent scouring.

G. If using stone, use 3 to 6 inch stone (min.) or as called out in contract drawings placed on filter fabric.

H. If using a prefabricated device such as Triangular Silt Dikes, then follow manufactures guidelines for installation.

I. Spacing between check dams is the same for all types.

MAINTENANCE

A. Check for sediment accumulation after each significant rainfall. Remove accumulated sediment when it reaches ½ of the dam's original height.

B. Check for erosion around edges of dam and extend dam if erosion is taking place.

C. Remove dam when surrounding area has been stabilized. Immediately stabilize area under dam.

3.04 CONSTRUCTION ROAD

INSTALLATION

A. Follow the existing contour as much as possible. Slopes should not exceed 10 percent.

B. Plan for temporary parking on naturally flat areas.

C. Stabilize the side slopes of all cuts and fills by grading all slopes to 2:1 or flatter for clay soils and 3:1 or flatter for sandy soils. All exposed slopes should be seeded and/or mulched as soon as possible

D. Lay down a 6-inch deep bed of coarse aggregate (1.5-3.5 inch stone) immediately after grading. Apply a tackifier or binder (see Dust Control).

E. Ensure that proper drainage is provided for and that all drainage along construction roads is directed to sediment control BMPs (temporary sediment basins, buffer zones, sediment barriers, etc.).

MAINTENANCE

A. Top dress roads and parking areas as needed.

B. Check drainage after rain events and ensure drainage is going to sediment control BMPs. Any bypasses shall be stopped and redirected to proper BMPs.

C. Replace aggregate as needed to maintain 6" deep bed.

3.05 DIVERSION

INSTALLATION

A. Minimum height of ridge (measured from bottom of channel to top of ridge) is 18 inches.

B. Make the top width of the ridge a minimum of 2 feet with 3:1 slopes.

C. Determine path of channel, ensuring that channel has a positive grade and ends at a stabilized outlet (see Level Spreader, Slope Drain or Temporary Sediment Basin for example).

D. Excavate channel, place dirt on downslope side, shape to specified dimensions and compact.

E. If diversion will be in place for more than 30 days, then seed after ridge has been shaped and before compaction.

F. On fill slopes, form channel at end of working day and do not compact until final grade is reached.

MAINTENANCE

A. Inspect after every storm and repair any breaches.

B. If channel continues to erode, then velocities are too high and channel must be stabilized with erosion control netting or other stabilization practices.

C. If diversion is at foot of steep slope and breaches continue to occur after successive storm events, then move diversion away from slope (if possible) and stabilize slope with mulch (see Soil Blankets).

3.06 LEVEL SPREADER

INSTALLATION

A. Construct on undisturbed soil (not fill).

B. Set last 20 feet of diversion slope to 1% grade before flow enters level spreader.

C. Size the level spreader at zero grade.

D. Slope sides at 2:1 or flatter.

E. Seed the level spreader with grass seed or sod within 7 days of construction.

MAINTENANCE

A. Inspect after each storm event to ensure that flow is not concentrating and causing erosion at outlet. Repair if necessary.

B. Remove any leaves and debris.

C. Prevent construction traffic across the structure.

3.07 SOIL BLANKETS (MULCH, MATS, BINDERS)

INSTALLATION – All Mulch, Mats, and Binders shall be installed in locations as required by the ENGINEER and per the manufacturer's recommendations. Improper product location or installation shall be removed and replaced by an approved material by the CONTRACTOR at no expense to the OWNER.

A. MULCH

1. The most common mulch is straw. When spreading by hand, divide the area to be mulched into 1000 square foot blocks and spread 2 square bales per block. When using equipment to spread mulch over larger areas use 2 tons per acre. When applying mulch to slopes equal to or steeper than 3:1, slopes with runs longer than 50 feet, areas of concentrated flow and in large open areas where wind is not blocked, mulch shall be anchored. Other mulch materials such as wood cellulose fibers, composted vegetation, recycled materials for mulch, and hay are acceptable. Apply enough material to obtain good coverage.

2. Anchor straw or hay mulch by crimping, by overlaying with an erosion control blanket, or by using a tackifier.

3. All other mulches should be anchored with an erosion control blanket or a tackifier.

4. When crimping use a mulch crimper (packer disc) or equivalent anchoring tool. The crimper should have discs that can be set straight, are 20 inches or more in diameter, 8 to 12 inches spacing between discs, and the disc edges are dull enough to press the stalks into the ground without cutting them. Ensure that the mulch stalks (or fibers) are pushed into the soil approximately 3 inches.

5. For any mulch material used, ensure that good coverage is obtained. Good coverage is where the mulch completely covers bare soil but is no more than 1 – 2 inches thick.

B. EROSION CONTROL BLANKETS (TRMs)

1. This type of product is known by several different names: erosion control blankets, erosion control matting, erosion control nets, rolled erosion control products, and turf reinforcement mat or materials.

2. Nets shall be used to anchor organic mulches on steep slopes and areas with concentrated flows.

3. Grade and compact area of installation and remove all rocks, clods, vegetation or other obstructions so that the installed

When used with seeding, prepare soil and place seed according to directions in temporary or permanent seeding.

4. Ensure that soil surface is free of rocks, roots or other debris.

5. Spread organic mulch.

6. Lay down netting on top of organic mulch ensuring firm, continuous contact with soil and anchor according to specifications.

C. INSTALLING ON SLOPES

1. On slopes netting shall be laid parallel to slope (parallel to primary direction of flow).

2. Dig a 6-inch by 6-inch trench at the top of the slope. Unroll 4 feet of the netting, line trench with netting while leaving 3 feet of netting extended past the trench.

3. Anchor netting in trench with staples, backfill and tamp soil firmly. Take remaining 3 foot strip that is extended past the trench and fold over the trench. Fasten strip to
netting with staples. Unroll netting down the slope.

4. Start at top of slope or grade, anchor net, and work down.

5. Where strips are laid side by side, overlap edges 3 inches and staple together.

6. When joining ends, anchor new net in trench, overlap with old net 18 inches and staple together below trench.

D. INSTALLING IN CHANNELS

1. In areas of concentrated flows (ditches, swales, storm water conveyance channels, etc.) lay netting in direction parallel to flow. Use turf reinforcement mats for greater strength.

2. Dig a 6-inch by 6-inch across the beginning of the channel (upstream end) where netting will be laid.

3. Anchor and unroll netting as described above.

4. Do not join strips of netting in the center area of concentrated flows.

E. SOIL BINDERS

1. If using manufactured mulches such as erosion control netting, straw blankets, wood fiber blankets, wood fiber mulch with tackifier, bonded-fiber matrix, etc., refer to manufacturer’s recommendation.

MAINTENANCE

A. Inspect periodically and after rainstorms.

B. Check for rills, dislocation, or failures, and repair.

C. If washout occurs, then regrade, reseed and remulch.

D. If washout continues, check to see if flow velocities or if contributing area are too great and install additional measures to slow velocities and/or divert a portion of the flow

3.08 TEMPORARY SEEDING

INSTALLATION

A. Loosen all soil that has been compacted, crusted, or hardened.

B. Test soil to determine liming and fertilization requirements. In the absence of a soil test, apply according to local soil conservation district's or a local nursery's direction.

C. Spread available topsoil over unfavorable soil conditions, especially exposed subsoil.

D. On slopes, the surface will require roughening, mulching, or both, depending on grade (see Mulching and Surface Roughening).

E. Apply seed uniformly.

F. Plant grass seed 1/4 inch deep (normal depth).

G. Water as needed.

MAINTENANCE

A. Inspect for germination and growth after 7 days from planting.

B. If seed is not germinating or growth is sparse, perform soil test, fertilize and reseed according to directions.

C. Inspect after rainstorms. Reseed wherever seed has been washed away (absorbed). Consider the use of erosion control netting, mulch, or other BMPs in areas where seed continues to be washed away and channels are forming.

3.09 TREE PRESERVATION

INSTALLATION

A. Select trees to be preserved shall be flagged by Owner prior to beginning construction.

B. Install barrier at or outside the dripline.

C. Do not use heavy equipment, vehicles, or stockpiles within the dripline.

D. Do not store any toxic materials within 100 feet of trees to be preserved.

E. Ensure that crew, especially operators of earth-moving equipment, know where the trees are and what the purpose of the fencing is.

F. Do not trench through the dripline. Tunnel or reroute utilities.

G. Do not nail anything to trees to be preserved.

MAINTENANCE

A. Note: If roots are cut, then prune tree by a proportionate amount (example, if 1/3 of the roots are cut, then prune tree by 1/3). Remove any damaged root area and paint the pruned area with tree paint.

B. Repair any damage to trunk by trimming around damaged area (tapering the cut), and paint with tree paint.

C. Cut off any damaged branches with a three cut process, and paint with tree paint

3.10 DUST CONTROL

INSTALLATION

A. Saturate surface as needed with any standard method to control dust.

B. Follow manufacturer's recommendations if using additives.

MAINTENANCE

A. Prohibit traffic on treated surface until curing time is complete.

B. Re-water as needed to control dust as required by Owner, Engineer or regulatory requirements.

3.11 STORM DRAIN INLET PROTECTION

INSTALLATION

A. SILT FENCE DROP INLET SEDIMENT FILTER

1. Use where drop inlet is surrounded by relatively flat ground and sheet flows are expected. Excavate a shallow depression around the inlet to allow for some ponding.

2. Construct a frame around the drop inlet using 2"x 4" stakes. Drive stakes into ground around drop inlet and no more than 3 feet apart. Drive stakes into the ground at least 12 inches. Attach a top rail of 2"x 4" to the stakes to stabilize the frame. Diagonally cross brace the stakes to prevent the water from pushing over the fabric. Ensure that water will fall directly into the inlet opening, not onto the unprotected soil around the inlet box.

3. Excavate a trench 6” x 6” around the outside edge of the frame.

4. Measure out filter fabric needed to ensure that fabric can be wrapped around frame with one overlap panel in order to ensure that there are no joints to separate.

5. Staple fabric to frame with 12 inches lying in the trench. The height of the fabric shall be at least 15 inches above ground but no more than 18 inches high.

6. Backfill trench and compact over fabric.

B. BLOCK AND GRAVEL DROP INLET PROTECTION

1. Use this where excavation cannot be done (i.e. to protect a storm drain in pavement) and/or where heavier concentrated flows are expected. Do not use where ponding will damage adjacent area or structures. Ensure that approaches are fairly flat to allow temporary ponding.

2. Place concrete blocks on their side, lengthwise around the inlet. Place blocks so that all ends are abutting. Height can be varied by stacking blocks but should be between 12 and 24 inches in height. Cover outside face of blocks with wire mesh.

3. Pile coarse aggregate (3/4 – 1.5”) against wire mesh.

C. GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER

1. Use where excavation can’t be done and surrounding soils are sandy. Use where concentrated flows may be expected but ponding won’t damage adjacent areas

2. Place wire mesh (1/2” openings) over drop inlet. Wire mesh must extend one foot past inlet on every side. Pile coarse aggregate (3/4”-1/2”) on the wire mesh. Pile it 12 inches high and slope the pile 18 inches past the inlet on all sides.

D. BLOCK AND GRAVEL CURB INLET SEDIMENT FILTER

1. Use around curb inlets where an overflow capability is needed to prevent excessive ponding.

2. Place two concrete blocks, on their side, on either side of the curb inlet. These are spacer blocks.

3. Place a 2x4 stud through the outer holes of the spacer blocks. This is used to hold the front blocks in place.

4. Place concrete blocks on their sides in front of the curb inlet and spacer blocks.

5. Place wire mesh (1/2” openings) over the outside face of the blocks.

6. Place 1.5” coarse aggregate against the wire mesh.

E. PREFABRICATED STORM INLET PROTECTION

1. Install according to manufacturer's specifications.

2. Can be used either to divert flows away from the inlet or create a very small ponding area to trap small amounts of sediment.

F. GRAVEL CURB INLET SEDIMENT FILTER

1. Use where ponding won't cause damage.

2. Place wire mesh (1/2" opening) over curb opening and top of curb.

3. Place 1.5" coarse gravel in front of and on top of wire mesh.

G. GRAVEL FILTER BAGS FOR CURB INLET PROTECTION

1. Install per manufacturer's recommendations

MAINTENANCE

A. Inspect the structure after each rain event and repair as needed.

B. Remove accumulated sediment when it has reached ½ of the height of filter. Clean filter.

C. Remove filter when drainage area has been permanently stabilized.

D. If there are unacceptable levels of flooding around inlet protection then remove cumulated sediment; or convert sediment barrier to an excavated sediment trap; or reroute runoff to a more suitable area

3.12 TEMPORARY SEDIMENT TRAP

A. A small ponding area formed by excavation and/or a low embankment across a drainage-way.

B. To detain sediment-laden runoff long enough for some sediment to settle out.

C. Sediment traps should be in use for 18 months or less.

D. Do not use in a stream.

E. Do not place a drain pipe with the inlet at the bottom of the trap and a silt fence across the inlet or outlet to filter sediment.

INSTALLATION

A. Embankment height shall be 5 feet or less.

B. Ensure that embankment fill material is free of roots, organic material, or any other objectionable material.

C. Construct embankment by placing fill material in 8-inch layers. Compact each layer. Side slopes shall be 2:1.

D. Set outlet crest at 1 foot to 18 inches below the crest of the embankment.

E. Install outlet protection

F. Seed embankment with temporary seeding within 7 days of construction (see Temporary Seeding).

G. Performance of sediment trap can be improved by seeding and/or mulching drainage area (see Soil Blanket).

H. Remove trap and regrade when drainage area is stabilized.

I. Sediment traps can also be constructed using gravelfilled sand bags as an embankment.

J. Excavating around a storm drain inlet will also create a sediment trap.

MAINTENANCE

A. Remove accumulated sediment when sediment has filled in ½ the original volume.

B. Check embankment after each storm event for erosion. Repair as necessary.

3.13 SILT FENCES

INSTALLATION

A. Temporary silt fences shall be placed at the bottom of fill slopes, in ditches, around stockpiled soils, or downstream of any area where ground has been disturbed. Contractor is responsible for placement of silt fence in locations and quanitites as needed to control erosion.

B. Bottom of fences shall be embedded a minimum of 6 into the soil and backfilled.

C. Additional rows of fencing or other measures shall be added as needed to control erosion.

MAINTENANCE

A. The Contractor shall maintain the silt fence in a satisfactory condition for the duration of the project. Silt fencing may not be removed until approval has been given by the Engineer.

B. Any silt fence that has deteriorated shall be replaced.

C. Silt shall be removed from behind silt fence when sediment has reached 1/2 the height of the fence. If fence is damaged from cleanout or has deteriorated it shall be replaced.

3.14 RIP RAP: See Section 313700

## PART 4 – COMPENSATION

### 4.01 GENERAL

A. No separate payment shall be made for any item necessary for the completion of the work indicated on the Contract Drawings and in the Specifications but not shown as a pay item on the proposal form; therefore, full compensation for these items shall be considered absorbed in the Contract Lump Sum or related pay items.

B. No additional compensation will be made for additional temporary erosion control measures that are implemented or required.

### 4.02 MEASUREMENT AND PAYMENT

It shall be understood that measurement and payment for erosion control will be an absorbed cost or will be made only when a pay item is included on the Proposal Form.

--END OF SECTION 015713--

# SECTION 31 0000 - EARTHWORK

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Earthwork Operations:

1. Site clearing and grubbing.
2. Site preparation, protection and special precautions.
3. Stripping operations and stockpiling of soils to be re-used.
4. Importing approved soils for fill.
5. Excavation and removal (off-site) of soils not to be re-used.
6. Excavation for pavements; including roadways, parking areas and walkways.
7. Excavation for building foundations.
8. Building and site backfilling and soil compaction operations.
9. Rough grading; including cutting, filling, compaction operations, preparing of sub-grade to receive pavements.
10. Construction under building floor slabs.
11. Free-draining, non-frost susceptible granular material for sub-base under buildings and pavement areas.
12. Relocation of existing soils on-site for specific uses; including topsoil, structural fill under building areas, parking lots and roads.
13. Finish grading; including spreading topsoil.

### 1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

2. ASTM D 75 - Standard Practice for Sampling Aggregates; 2009.

3. ASTM D 422 - Standard Test Method for Particle-Size Analysis of Soils; 2007.

4. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2007e1.

5. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

6. ASTM D1586- Penetration Test and Split-Barrel Sampling of Soils; 2011.

7. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008.

8. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

9. ASTM D 2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure); 2009a.

10. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

## 1.3 SUBMITTALS

A. Submit under the provisions of Division One Specifications.

B. Samples: Submit ten (10) pound (4.5 kg) sample of each type of fill to Independent Testing Laboratory, in airtight containers.

C. Test Reports: Submit Independent Testing Laboratory reports which pertain to testing services performed at the site under the provisions of Division One Specifications.

## 1.4 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. Codes and Standards: Perform excavation work and disposal of debris in accordance with applicable requirements of governing authorities having jurisdiction.

E. All excavations and trenches shall comply with the requirements of OSHA 29 CFR, Part 1926, Sub-Part B, “Excavations and Trenches.”

F. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

G. The Contractor is to employ the services of a Registered Land Surveyor to perform the specified layout work and to prepare a grade verification survey. Refer to Field Quality Control of this section.

H. After the date of Substantial Completion and prior to the release of retainage, the Record Drawings shall be transmitted to the Architect.

## 1.5 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding.

B. Protection of Persons: Install barricades as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements.

## PART 2 PRODUCTS

### 2.1 ACQUISITION OF MATERIALS

A. Insufficient Materials: Provide necessary material from off the site, as approved by the Architect/Engineer and Geotechnical Engineer to complete the Work.

B. Exterior Backfill: Clean, on-site materials obtained from the required stripping, contour cutting and excavation may be used for backfill and grading.

C. Subsoil for Site Grading: Clean, on-site materials obtained from the earthwork operations.

D. Under-slab Fill: Obtain from on or off the site as approved by the Laboratory Inspector.

E. Fill: Obtain from on or off the site as approved by the Laboratory Inspector.

F. Disposition of Materials

1. Surplus Earth: Unless designated elsewhere for use or disposal on the Owner's property, surplus earth becomes the property of the Contractor and shall be removed from the Owner's site. The cost of off-site disposal shall be considered part of the Base Bid Contract.

2. The Contractor shall not be allowed to take advantage of the stated tolerances by maintaining a consistently high or low elevation.

### 2.2 MATERIAL BALANCE

A. The Contractor is responsible for determining the quantities of material necessary for completing the Work under this Section. This includes the cost of importing approved fill or exporting excess materials.

## PART 3 EXECUTION

### 3.1 PREPARATION

A. Identify required lines, levels, contours, and datum locations. Verify that survey benchmarks and intended elevations for the Work are as indicated on the Drawings.

B. Identify known underground, above ground and aerial utilities. Stake and flag utility locations. Protect above and below-grade utilities which are to remain.

C. Verify that erosion control devices are in place.

D. Verify limits of construction and accurately locate the site boundaries, building perimeter and paved areas.

## 3.2 PROTECTION

A. Protect utilities that remain, from damage.

B. Protect trees, plant growth and features designated to remain as final landscaping.

C. Protect benchmarks, existing structures, fences, sidewalks, paving, curbs and other items indicated on the Drawings to remain.

## 3.3 SPECIAL PRECAUTIONS

A. Dewatering:

1. Prevent surface water and subsurface (ground) water from flowing into excavations and from flooding the site and surrounding area.

2. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3. Convey water removed from excavations and rainwater to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

B. Stability of Excavations:

1. Sidewalls of all excavations shall comply with the most current OSHA regulations and applicable local building codes and ordinances. Shore and brace where adequate sloping is not feasible because of space restrictions or stability of material being excavated.

2. Maintain slopes of excavations in safe condition until completion of backfilling.

C. Cold Weather Protection:

1. Protect excavation bottoms and bearing surfaces against freezing when atmospheric temperature is less than 35 degrees Fahrenheit (2 degrees C).

## 3.4 EXCAVATIONS

A. Excavate to the lines, grades and slopes as indicated on the Drawings.

B. Provide temporary drainage where construction interferes with existing drainage.

C. Protect and brace existing footings before performing soil corrections within the zone of influence below the existing footings. The zone of influence is defined as the area below a line commencing three (3') feet outside the footing at footing elevation and extending down at a slope of one (1') foot vertical for each foot horizontal. The Contractor shall stop and consult the

Geotechnical Engineer and Structural Engineer if it appears that soil correction is required within the zone of influence of the existing footings.

D. Stabilizing Sides of Excavation: Slope the sides of excavations to a safe angle of repose for materials being excavated. Shore and brace where sloping is not possible because of space restrictions or the stability of the materials being excavated. Maintain the sides of the excavations in a safe condition until the completion of backfilling.

## 3.5 EARTHWORK REQUIREMENTS

A. Earthwork Procedures for Paved Roadways, Walkways and Parking Areas:

1. Remove pavement and/or strip topsoil from areas not cleared under Section 02 4113 or Section 31 1000.

2. In cut areas subcut to the depth required for installation of proposed pavement section.

3. Prior to placing fill materials, proof roll subgrade to detect soft or loose zones where additional excavation depths may be required.

4. All unsuitable material shall be excavated and removed from pavement areas as directed by the Geotechnical Engineer.

5. For roadways and parking areas, refer to Section 32 1122 for stabilized aggregate base.

B. Building Floor Slabs and Footings:

1. The Contractor shall thoroughly review the Geotechnical Report, Grading Plans, Structural Plans and Specifications to determine depth of excavation and any soils correction required. No additional compensation will be given for work that could have been anticipated by reviewing the above documents.

2. The soil corrections shall conform to the requirements of the soils report and the on-site observations of actual conditions made by the Independent Testing Agency. The Geotechnical Engineer shall inspect footing excavation bottoms. The contractor shall comply with the required corrective procedures to obtain satisfactory footing excavation bottoms.

3. The exposed subgrade soils shall be tested by the Independent Testing Agency. Remove and replace unsuitable soils as directed by the Geotechnical Engineer. No additional compensation will be allowed for exporting or importing of soils.

4. The compacted building pad area shall be brought to true even plane to the base of the sand cushion elevation.

## 3.6 BACKFILLING PROCEDURES

A. Employ a placement method that does not disturb or damage foundation perimeter drainage, foundation damp proofing and protective cover.

B. Slope grade away from building at landscaped areas a minimum three (3") inches in ten (10') feet, unless noted otherwise.

## 3.7 SITE GRADING

A. Rough Grading: Grade subsoil to a minimum elevation six (6") inches below finish grade. Soil most suitable for lawns shall be spread as top layer. Rough grading shall include spreading the material on the site smoothly and evenly with a dozer or equal equipment, leaving it similar to back dragging with a dozer.

B. Finish Grading: Spread topsoil to a minimum depth of six (6") inches and apply sod.

C. Compaction: Compact subsoil and topsoil as necessary to prevent settlement without inhibiting vertical drainage and subsequent turf establishment. If over-compaction occurs, the Contractor may be required to scarify soil and reblade. The depth of the topsoil shall be measured after compaction.

## 3.8 COMPACTED FILL

A. Prior to the placement of fill, the Geotechnical Engineer must inspect and approve the bottom or bearing surface of each excavation. Once approved, the exposed surfaces shall be scarified to a depth of not less than six (6") inches and then compacted to at least 100 percent Standard Proctor Density.

B. Fill shall not be placed on frozen ground, nor shall filling operations continue when the temperature is such as to permit the layer under placement to freeze.

C. Deposit approved fill in uniform layers not exceeding eight (8") inches (loose) thickness. Compact each layer with approved methods and equipment.

D. The fill material, when being compacted, shall contain the moisture content necessary for the required compaction as designated by the Geotechnical Engineer. The soil shall be moisture conditioned to within 2 percent of optimum moisture content. The moisture shall be uniform throughout each layer.

E. Scarify, remove, recompact or otherwise rectify all soft or yielding areas resulting from construction operations, rain or other sources.

F. Compaction of Trenches for Underground Piping:

1. General Requirements: Place the fill and compact in connection with the installation of the underground plumbing pipe in the Mechanical Contract as follows:
    a. Exterior: Refer to Section 31 2333 - Trench Excavation and Backfill for Utilities.
    b. Interior: Refer to Mechanical Specifications.

G. Coordination: The General and Mechanical Contractors shall cooperate in the digging, backfilling and compacting operations.

## 3.9 ROUGH GRADING

A. The grades shown on the Drawings are proposed finish grades. The Contractor shall grade to the prescribed subgrade elevations except in landscaped areas, which shall be graded to finish grade with approved topsoil.

B. The Contractor shall be solely responsible for determining quantities of fill and waste materials to be handled and for amount of grading to be done in order to completely perform all work indicated on the Drawings. The costs of importing fill and/or exporting excess materials from the site shall be considered part of the Base Bid Contract.

C. Provide surfaces free of debris and building materials. Complete rough grading by blading to reasonably smooth contours with neat, uniform transitions and slopes. Remove stones over two (2") inches diameter, branches and other vegetation. Ease new grades into surrounding existing grades without awkward or abrupt transitions.

D. All surfaces shall be finished to such contour that they will not impound surface water.

1. Rough grade tolerances are as follows:
    a. Unpaved areas outside buildings: Not more than two-tenths (0.20') feet above or below finish grade elevations shown on the drawings.
    b. Building and paved areas: Surfaces shall not vary by more than five one-hundredths (0.05') foot above or one-tenth (0.10') foot below the subgrade elevations referenced to herein.

E. Protect newly graded areas from traffic and erosion. Repair and re-establish grades in settled, eroded and rutted areas to specified tolerances.

## 3.10 SUB-GRADE TREATMENT

A. Compact and shape the subgrade for its entirety as may be necessary to produce, at the time base is placed, the specified density and stability in the top twelve (12") inches of the subgrade and the grades indicated on the Drawings.

B. The subgrade shall be compacted with approved equipment to a minimum relative density of 95 percent Standard Proctor Density (ASTM D 698).

C. All building areas and areas to be paved shall be brought to within five one-hundredths (0.05) feet of subgrade elevations and cross sections.

D. The required subgrade stability shall be such that during placement of the base, rutting and displacement does not occur. Maximum yield: One (1") inch (measured from the top of the constructed subgrade to the bottom of the rut).

E. All proposed pavement subgrades shall be tested for compaction immediately prior to placement of aggregate base course.

F. If test rolling shows any area to be unstable, the Contractor shall, at their expense, scarify the area and aerate or add moisture to the soil as necessary, and recompact the soil to the extent it will be stable when retested by rolling.

G. All pavement areas shall be test rolled in the presence of the Geotechnical Engineer.

3.11 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Retain the services of a Registered Land Surveyor to prepare a grade verification survey as required in Quality Assurance of this section. This surveyor shall check the subbase elevation after the utilities are installed.

1. Centerline of streets and drives at fifty (50') foot intervals and slope change locations.

2. Parking lots on a seventy-five (75') foot grid and slope change locations.

3. Landscape areas on a seventy-five (75') foot grids and slope change locations.

4. The surveyor shall supply a letter certifying that the grades are within the specified tolerance range.

C. Field-testing and inspection shall be performed by qualified parties as specified herein and in accordance with the provisions of Division One Specifications.

D. Conventional testing and inspection services herein describe those items not specifically required by State Building Code, but are considered essential to the proper performance of the building systems.

E. Verify that footing bearing surfaces comply with frost depth requirements and report variances in a timely manner.

F. Classification of materials used and encountered during construction will be performed in accordance with ASTM D2488 and D2487.

1. Inspect each footing and slab subgrade to determine if subgrade materials are acceptable. Perform hand auger borings, soil classifications and dynamic cone penetrometer tests to verify if design-bearing capacity is achieved.

2. Inspect, test and approve excavated soils to be used as backfill materials under buildings and site improvements.

3. Inspect and test backfill operations to insure acceptability of materials being placed, method of placement, thickness of layers and compaction of backfill.

4. Inspect and test backfill operations along foundation walls to insure acceptability of materials being placed and compacted so that settlement will not occur.

G. The geotechnical testing laboratory shall advise the Owner, Contractor and Architect of any materials or operation that in their professional opinion will not produce the specified results. The geotechnical testing laboratory shall perform the following:

1. Observe and evaluate the soil conditions at the bottom of all excavations, determine limits of excavation where applicable and evaluate and document depth and width.

2. Perform analysis for on-site and borrow soils for suitability as backfill.

3. Observe, evaluate and report contractor's operations within context of soil limitations and project requirements.

4. Perform density tests on compacted backfill materials.

5. Compaction testing shall be performed in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

6. Observe all subgrades and excavation bases below footings and slabs before further construction is performed.

7. Document presence of ground water within excavations. Verify cut and fill slopes as specified in the Contract Documents.

H. If tests indicate that the Work does not meet the specified requirements, remove the Work, replace and retest at no cost to the Owner.

I. Frequency of Tests:

1. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one (1) test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to the Architect/Engineer.

2. Compaction tests of subgrade shall be made at maximum horizontal intervals of fifty (50') feet in each direction, or as directed by Architect/Engineer.

3. Compaction tests of in-place backfill materials shall be made at a maximum vertical interval of twelve (12") inches, and maximum horizontal intervals of fifty (50') feet in each direction, or as directed by the Architect/Engineer.

END OF SECTION

# SECTION 31 1000 - SITE CLEARING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Remove trees, underbrush, undesirable growths, stumps, roots, etc. from the area to the limits indicated on the Drawings, specified herein, and as required to meet the contract documents.

C. Site clearing operations:

1. Selective site clearing and grubbing of trees and brush.

2. Selective tree removal and trimming.

3. Stripping topsoil.

4. Stockpiling of topsoil.

5. Tree pruning and trimming.

D. Clearing and protection of vegetation.

E. Removal of existing debris.

### 1.2 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. Codes and Standards: Perform excavation work and disposal of debris in accordance with applicable requirements of governing authorities having jurisdiction.

E. Use equipment adequate in size, capacity and number to accomplish the Work in a timely manner.

F. Comply with requirements of governmental agencies having jurisdiction.

## 1.3 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. Protection of Persons: Install barricades, as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities currently exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section. All repairs are part of the Base Bid Contract.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements. No additional compensation will be allowed to provide these services.

F. The Contractor shall review proposed and finished grade elevations as well as the proposed pavement thicknesses. Remove pavement and aggregate only as necessary to achieve proposed finished grade.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours and datum. Verify that survey benchmark and intended elevations for the Work are as indicated on the Drawings.

3.2 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

1. Protect benchmarks, existing structures, fences, sidewalks, paving, curbs and other items indicated on the Drawings to remain.

E. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated on the Drawings or as necessary to facilitate new construction.

3.3 PROTECTION

A. Protect trees, plant growth and features designated to remain as final landscaping.

3.4 CLEARING AND GRUBBING

A. Clearing and Grubbing: The entire area within the limit lines described above shall be cleared and grubbed. Remove all vegetation, trees, brush, stumps, etc. from the area. All debris from this operation shall be disposed of off the Owner's property.

B. Selective clearing shall be done in areas designated by the Architect. Selective clearing shall consist of removing vegetation, brush, stumps, etc. from the area. Selected trees shall be left standing and care shall be taken to protect trees designated to remain. All debris from this operation shall be disposed of off the Owner's property. Grubbing will not be required in areas designated for selective clearing.

C. Cutting and removing trees, shrubs, bushes, windfall and other vegetation: Cut brush within six (6") inches of the ground surface. Remove, as directed, any low hanging, unsound or unsightly branches on the trees and shrubs designated to remain.

D. Remove and dispose of stumps, roots and other remains. Remove stumps completely. Except in areas to be excavated, backfill depressions resulting from the grubbing operations with suitable material and compact to the specified requirements.

E. Remove timber, stumps, roots and other debris or by-products resulting from the clearing and grubbing operations from the site. If any wood is run through a chipping machine, the wood chips shall be immediately recovered and disposed of off the site.

F. Grubbing operations shall consist of removing and disposing of the stumps, roots and other remains in the construction area in their entirety.

## 3.5 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.

B. Do not begin clearing until vegetation to be relocated has been removed.

C. Install substantial, highly visible fences to prevent inadvertent damage to vegetation to remain:

D. Vegetation Removed: Do not burn, bury, landfill, or leave on site.

E. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.

F. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner and to Owners satisfaction.

## 3.6 SPECIAL PRECAUTIONS

A. Dewatering:

1. Prevent surface water and subsurface (ground) water from flowing into excavations and from flooding the site and surrounding area.

2. Do not allow water to accumulate in excavations. Remove water to prevent soil changes detrimental to stability of subgrades and foundations. Provide and maintain pumps, well points, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

3. Convey water removed from excavations and rainwater to legal collection or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

3.7 DEBRIS

A. Remove debris, junk, and trash from site.

B. Burning of debris is not permitted on the Owner's property.

C. Remove all waste materials and unsuitable or excess topsoil from the Owner's property.

D. The cost of disposal of waste materials is considered part of the Base Bid Contract.

E. Leave site in clean condition, ready for subsequent work.

F. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

# SECTION 312000 - EARTH MOVING

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses, and plants.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for concrete slabs-on-grade.
4. Subbase course for concrete walks pavements.
5. Subbase course and base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

### 1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.3 QUALITY ASSURANCE

A. Preexcavation Conference: Conduct conference at Project site.

## 1.4 PROJECT CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

B. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

# PART 2 - PRODUCTS

## 2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D 2487, or a combination of these groups; free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

## 2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.

# PART 3 - EXECUTION

## 3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

## 3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

## 3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

## 3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

## 3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material, 4 inches (100 mm) deeper elsewhere, to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

## 3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

## 3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

## 3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

## 3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."

E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

## 3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

## 3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

## 3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches (100 mm) in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.

2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 85 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

## 3.13 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

## 3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.
2. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
3. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

## 3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

## 3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. 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 materials to depth required; recompact and retest until specified compaction is obtained.

## 3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

## 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

# SECTION 31 2333 - TRENCHING AND BACKFILLING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Trench Excavation, Backfilling and Compaction as indicated on the Drawings, specified herein; and as needed for installation of underground utilities associated with the Work.

### 1.2 REFERENCES

A. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

B. ASTM D75 - Practice for Sampling Aggregates; 2009.

C. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils; 2007.

D. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2007.

E. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2008a.

G. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

### 1.3 SUBMITTALS

A. Refer to Division One Specifications for submittal procedures.

B. Samples of each type of fill; submit in air-tight containers to testing laboratory.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

## 1.4 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

E. Codes and Standards: Perform excavation work and disposal of debris in accordance with applicable requirements of governing authorities having jurisdiction.

F. All excavations and trenches shall comply with the requirements of OSHA 29 CFR, Part 1926, Sub-Part P, “Excavations and Trenches.”

G. Use equipment adequate in size, capacity and number to accomplish the Work in a timely manner.

## 1.5 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications and Geotechnical Report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. The Contractor shall carefully review plans and identify utilities that are to be verified prior to construction.

C. Existing Utilities:

1. Existing utilities currently exist within the construction areas, including waterworks, storm drainage, sanitary sewers, gas mains and other utilities.

2. Locate these and other possible unknown utility lines.

3. The Contractor shall carefully review the plans and identify utilities that are to be verified prior to construction.

4. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section. All repairs are part of the Base Bid Contract.

5. The Contractor shall become familiarized with the existing conditions and be prepared to adequately care for and safeguard themselves and the Owner from damage.

D. Protection of Persons: The Owner's activities will continue in and about the site during construction. Install barricade fencing (snow fence), as necessary, to provide a safe environment between construction work and owner's activities.

E. Benchmarks and Monuments: Maintain and protect benchmarks and monuments that exist on the site.

F. Protection of Existing Property to Remain: Protect existing equipment and structures which are in the area where the Work will be performed and which are to remain. Repair or replace existing property which is to remain that is damaged by the Work, to the Architect's or jurisdictional authority's satisfaction and at no cost to the Owner and the Owner's Representatives.

G. Protecting Trees, Shrubbery and Lawns:

1. Trees, plants and shrubbery in developed areas and along the trench line shall not be disturbed unless absolutely necessary, and subject to the approval of the Architect.
    a. Any such trees, plants and shrubbery necessary to be removed shall be heeled in and replanted.

2. Where trenches cross private property through established lawns, sod shall be cut, removed, stacked and maintained in a suitable condition until the Architect approves replacement.
    a. Topsoil underlying lawn areas shall be removed and kept separate from general excavated materials.

H. Clearing:

1. Perform all clearing necessary for installation of the complete Work.

2. Clearing shall consist of removing all trees, stumps, roots, brush and debris in the right-of-way obtained for the Work.

3. All other material, including trimmings from above, shall be completely disposed of off the site in a satisfactory and legal manner.

I. Removing and Re-Setting Fences:

1. Where existing fences must be removed to permit construction of utilities:
    a. Remove such fences, and as the Work progresses, reset the fences in their original location and condition. If fence cannot be reset to its original quality, the Contractor is to replace the fence with new material. This is considered part of the Base Bid Contract.

J. Restoration of Disturbed Areas:

1. The Contractor shall restore, to a condition equal to or better than existing, all other structures not specifically mentioned above which are disturbed because of this construction including fences, clothes line posts, mailboxes, yard lights, entrance markers, etc. There will be no additional compensation for this miscellaneous restoration.

2. All work in public right-of-way is to meet governing agencies standards. The Contractor is to contact the governing agencies to fully understand the scope of work. No additional compensation will be given for unanticipated work in governing agency right-of-way.

3. All surplus waste materials remaining after completion of the backfilling operations shall be disposed of in an acceptable manner within 24 hours after completing the backfill work on each particular pipeline section. Disposal at any location within the project limits shall be as specified, or as approved by the Architect; otherwise, disposal shall be accomplished outside the project limits at the Contractor's discretion. The backfilling and surplus or waste disposal operations shall be a part of the Work required under the pipeline installation items, not as work that may be delayed until final cleanup.

4. Surface improvements such as pavement, curbing, pedestrian walks, fencing or turf disturbed by this Contractor outside of the general demolition area shall be repaired or replaced to the satisfaction of the responsible party, i.e., the Owner, Architect, other governmental body. The improvement shall be restored to the pre-exiting condition. Each item of restoration work shall be done as soon as practicable after the completion of installation and backfilling operations on each section of pipeline.

5. The restoration work shall be compensated as part of the Work required under those contract items which necessitated the destruction and/or replacement and repair, and there will be no separate payment for restoration. Any improvements removed or damaged unnecessarily or undermined shall be replaced or repaired at the Contractor's expense.

6. Turf restoration shall be accomplished by sod placement except where seeding is specifically allowed or required.
    a. Topsoil shall be placed to a minimum depth of six (6") inches under all sod. Topsoil shall be light, friable loam, free of heavy clay, coarse sand, stones, sticks and other foreign matter.

7. Pavement Restoration (except in public right-of-way).
    a. The in-place pavement structure (including base aggregates) shall be restored in kind and depth as previously existed, using base aggregates salvaged from the excavated materials to the extent available and needed and with new materials being provided for reconstruction of the concrete or bituminous surface courses.
    b. The Contractor may re-use salvaged aggregate base as part of the restored section if approved by the geotechnical engineer. However, if there is insufficient salvaged aggregate available, additional compensation will not be granted for importing new material.
    c. Reconstruction of aggregate base courses and concrete or bituminous surface courses shall be in substantial compliance with all applicable Specifications pertaining to the item being restored. The material used shall be comparable to those used in the in-place structure and the workmanship and finished quality shall be equal to that of new construction to the fullest extent obtainable in consideration of operational restrictions.
    d. Existing concrete and bituminous surfaces at the trench wall shall be sawed or cut with a cutting wheel to form a neat edge in a straight line before surfaces are to be restored. Sawing or cutting may be accomplished as a part of the removal or prior to restoration at the option of the Contractor. However, all surface edges will be inspected prior to restoration.

K. Minimizing Silting and Bank Erosion During Construction:

1. During construction, protective measures shall be taken and maintained to minimize silting and bank erosion of creeks and rivers adjacent to the Work being performed during construction.

2. Sack breakers, silt fence, biologs or slope stabilizer mats are to be used on steep slopes along creek banks and fill slopes to prevent washing of ditch. The above-mentioned items are to be used at the direction of the Architect, local government body. All costs are part of the Base Bid Contract.

3. The Contractor is to refer to Section 01 5713 - Erosion and Sediment Controls.

4. The Contractor shall, at their own expense, control all erosion at the outfall and downstream of the dewatering pipe. The Contractor shall also be responsible for applying for and obtaining all permits that may be required with no direct compensation therefore.

L. Blasting will not be permitted.

## PART 2 PRODUCTS

### 2.1 EXCAVATED MATERIALS

A. Perform all excavations of every description and of whatever substances encountered to depths indicated on the Drawings or as specified.

B. Pile materials for backfilling in an orderly manner at a safe distance from banks or trenches to avoid overloading and to prevent slides or cave-ins.

C. Remove and deposit unsuitable or excess materials in a legal manner off-site. This is considered part of the Base Bid Contract.

### 2.2 GRANULAR MATERIALS

A. Granular materials furnished for foundation, bedding, encasement, backfill, or other purposes as may be specified shall consist of any natural or synthetic mineral aggregate such as sand, gravel, crushed rock, crushed stone or slag, that shall be so graded as to meet the gradation requirements specified herein for each particular use.

### 2.3 OTHER MATERIALS

A. Provide and install other materials for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect. This includes public right-of-way work.

2.4 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. Locate, identify, and protect utilities that remain and protect from damage.

C. Notify utility company to remove and relocate utilities.

D. Examine the areas and conditions under which the Work of this section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COLD WEATHER OPERATION

A. No pipe shall be placed when the temperatures fall below 30° Fahrenheit, without approval of the Architect.

3.3 OFF SITE DISPOSAL

A. The Contractor will be required to dispose of all bituminous, concrete and other undesirable debris to an approved landfill located outside the project limits with no direct compensation made therefore.

3.4 CLASSIFICATION AND DISPOSITION OF MATERIALS

A. Excavated materials will be classified for payment only to the extent that the removal of materials as classified as rock, by the Architect, will be paid for separately from other unclassified materials as an Extra Work Item. All other materials encountered in the excavations will be considered as Unclassified Excavation and no additional compensation will be provided for removal of wood, debris, boulders, stone, masonry, concrete or rock fragments less than one (1) cubic yard in volume, together with other miscellaneous matter that can be removed effectively with power-operated excavators without resorting to drilling and blasting.

B. Rock excavation is defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder stone, masonry or concrete fragments exceeding one (1) cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power-operated excavator will not be classified as rock excavation.

C. Excavated materials will be classified by the Independent Testing Lab for re-use as being either suitable or unsuitable for backfill or other specified use, subject to selective controls. All suitable materials shall be reserved for backfill to the extent needed and any surplus remaining shall be utilized for other construction of the project as may be specified or ordered by the Architect. To the extent practicable, granular materials and topsoil shall be segregated from other materials during the excavating and stockpiling operations so as to permit best use of the available materials at the time of backfilling. Material handling as described above shall be considered part of the Base Bid Contract with no additional compensation provided.

D. All excavated materials reserved for backfill or other use on the project shall be stored at locations approved by the Architect that will cause a minimum of inconvenience to public travel, adjacent properties and other special interests. The material shall not be deposited so close to the edges of the excavations creating hazardous conditions, nor shall any material be placed so as to block the access to emergency services. All materials considered unsuitable by the Laboratory Inspector or Architect, for use on the project, shall be immediately removed from the project and be disposed of as arranged for by the Contractor at no extra cost to the contract.

## 3.5 SHEETING AND BRACING

A. The Contractor shall be solely responsible for the safety of the excavation relating to angle of repose and/or bracing.

## 3.6 TRENCH EXCAVATION

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Work shall be done by open trench excavation except jacked or augered pipe designated on the plans or as directed by the Architect or governing agency.

C. Topsoil shall be stripped from the trench and stockpiled for reuse over all disturbed areas to be seeded or sodded. Stripping, stockpiling and respreading topsoil will be considered part of the Base Bid Contract.

D. Trench excavation shall be dug to the alignment and depth shown on the plans and only one hundred (100') feet in advance of the pipe laying. The trench shall be braced and drained so that workmen may work safely and efficiently therein.

E. Trench water shall be drained from the trench into natural drainage channels or storm sewers, if acceptable, and shall be considered part of the Base Bid Contract. Draining trench water into sanitary sewers will not be permitted. Prior to draining trench water directly into any natural

drainage channel or storm sewer, the Contractor is to contact the proper City, County and State agencies to obtain permission. Dewatering operations shall be monitored for sedimentation and treated prior to discharge to public storm water conveyance systems.

F. Braced and sheeted trenches shall be put in place and maintained as may be required to support the side of the excavation and to prevent any movement which may in any way endanger personnel or injure or delay the Work or endanger adjacent buildings or other structures. Where sheeting and bracing are used, the trench width shall be increased accordingly. Trench sheeting shall remain in place until the pipe has been laid, tested for defects and repaired if necessary, and the earth around it compacted to a depth of one (1') foot over the top of the pipe. It shall be the Contractor's responsibility for compliance therein.

G. Excavated material shall be piled in a manner that will not endanger the Work and that will avoid obstructing sidewalks, driveways and drainage. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

H. The maximum width of the trench at the top of the pipe shall be thirty six (36") inches or two times the pipe diameter plus eighteen (18") inches, whichever is greater.

I. Unless otherwise specified on the plans, all pipes shall be placed in a flat bottom trench with tamped backfill. The sides of the trench shall slope back to provide a stable slope for the particular type of soil in the trench.

J. If the trench is excavated to a greater width than authorized, the Architect may direct the Contractor to provide a higher class of bedding, a higher strength pipe or both, than that required by the Contract, without additional compensation therefore, as the Architect may deem necessary to satisfy the design requirements.

K. Faulty grade of the trench below grade lines shall be corrected with approved material thoroughly compacted without additional compensation to the Contractor.

L. When excavation is encountered that is unsuitable for backfill, it shall be removed as directed by the Geotechnical Engineer.

M. The Contractor shall be solely responsible for the safety of the excavation relating to angle of repose and/or bracing.

## 3.7 PREPARATION OF SOIL DURING PIPE LAYING

A. At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate. No pipe material shall be laid in water or when the trench or bedding conditions are otherwise unsuitable or improper.

B. If trench bottom conditions are encountered which appear to require stabilization, the Architect shall be informed. The trench conditions shall be examined by the Independent Testing Lab to determine the nature of such instability. If it is determined that the trench bottom cannot support the pipe, a further depth and/or width shall be excavated and refilled to the pipe foundation grade with granular foundation material and thoroughly compacted.

C. If the examination by the Architect reveals that the above described conditions are caused by the Contractor's manipulation of the soils in the presence of excessive moisture or lack of proper dewatering, the Contractor shall take such steps as are necessary to stabilize the trench bottom including the use of pipe support material and improved dewatering methods. In such case, the cost of necessary measures shall be borne by the Contractor.

D. When the bottom of the trench consists of material suitable to properly support the pipe, the following methods of bedding shall apply:

1. Granular bedding material shall be placed below the midpoint of the pipe, prior to the pipe installation, to facilitate proper shaping and achieve uniform pipe support, using hand compaction methods.

2. Granular backfill material at the pipe zone shall be free from rock, boulders or other unsuitable substances and shall be deposited into the trench simultaneously on both sides of pipe for the full width of the trench in six (6") inch lifts thoroughly compacted to a minimum elevation of one (1') foot above the top of the pipe. Compaction shall be accomplished by mechanical tamping.

3. The backfill material shall be placed to the top of the trench of subgrade elevation in level, successive layers, having a thickness of not greater than twelve (12") inches. Each successive layer shall be thoroughly compacted as specified prior to the placement of additional layers. If the specified compaction is not being attained utilizing the equipment and materials available, the thickness of the layers shall be reduced. The addition of water to the backfill materials should be limited to achieving satisfactory moisture content for compaction control, if necessary. Compaction of the backfill should be attained using vibratory, non-vibratory or mechanical rammer-type compactors. The type of compactor is dependent on the type of backfill material used. Precautionary measures should be taken to assure that the compaction equipment will not damage the underlying pipe.

4. Backfilling shall not take place at any time unless approved compaction equipment is available at the site.

E. Ledge rock, boulders and large stones shall be removed to provide a clearance of at least six (6") inches below the outside barrel of the pipe or fittings, and to a clear width of six (6") inches on each side of the pipe and appurtenances for pipes sixteen (16") inches or less in diameter; for pipes larger than sixteen (16") inches, a clearance of nine (9") inches below and a clear width of nine (9") inches on each side of outside diameter of pipe shall be provided. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. All costs associated with removing and disposing of ledge rock, boulders and large stones are considered part of the Base Bid Contract.

F. Excavations below subgrade in rock or in boulders shall be refilled to subgrade with material approved by the Independent Testing Lab and thoroughly compacted.

G. Where trench excavation is encountered which is unsuitable for backfill, such material shall be replaced with granular backfill to be supplied by the Contractor at the direction of the Independent Testing Lab. All costs of importing granular backfill are part of the Base Bid Contract.

H. Where pipes are of sufficient size to create an excess of backfill material, the excess shall be hauled off the site. Hauling and grading of the excess backfill will be considered part of the Base Bid Contract.

I. Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement shall be supplied by the Contractor with no extra compensation allowed.

J. Backfill in trenches in areas to be paved shall be placed to an elevation that will permit the placement of base and surfacing materials.

K. Trench backfill in pavement areas shall be placed in lifts no greater than eight (8") inches thick, at a moisture content within two (2) percentage points of optimum, to a compacted relative density of at least 95 percent of Standard Proctor Density (ASTM D698) at depth, with the upper three (3') feet compacted to 98 percent of Standard Proctor Density.

L. Trench backfill in unpaved areas shall be placed in lifts no greater than twelve (12") inches thick, at moisture content within two (2) percentage points of optimum and compacted to a relative density of at least 85 percent of Standard Proctor Density.

M. Trench backfill compaction around all utility structures shall be accomplished as follows:

1. Within five (5') feet of all utility structures, backfill compaction by mechanical roller vibrators will not be allowed, but shall be accomplished by using whatever mechanical means the Laboratory Inspector deems appropriate and shall be compacted in layers with material not to exceed eight (8") inches in depth.

## 3.8 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field inspection and testing.

B. Field-testing and inspection shall be performed by qualified parties as specified herein and in accordance with the provisions of Division One Specifications.

C. Conventional testing and inspection services herein describe those items not specifically required by State Building Code, but are considered essential to the proper performance of the building systems.

D. Classification of materials used and encountered during construction will be performed in accordance with ASTM D2487 and ASTM D2488.

E. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

F. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 (Standard Proctor).

G. Document presence of ground water within excavations. Verify cut and fill slopes if specified in the Contract Documents.

H. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner or the Owner's Representative.

I. Frequency of Tests:

1. Compaction tests shall be performed at the rate of one (1) test per one hundred (100') feet of trench or portion thereof and two (2) tests at each structure with one (1) test below the upper three (3') feet of backfill and one (1) test in the upper three (3') feet of backfill. The majority of the trench backfill tests shall be below the upper three (3') feet.

J. Proof roll compacted fill surfaces within trenches.

K. The Contractor shall make, or provide for, all repairs and replacements to improvements affected by settlement of backfill within 30 days after notice from the Architect or the Owner.

## 3.9 CLEAN-UP

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 313700 – RIPRAP AND SLOPE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK: This work shall consist of furnishing and placing a protective covering of erosion resistant material including plastic filter fabric for pier, slope or ditch protection. The Contractor shall furnish and place grouted rubble riprap or random riprap of the type and depth designated and in reasonably close conformity with the lines, grades and thicknesses shown on the Plans or specified in the Proposal. This work shall consist of furnishing and transportation of material, placement, wetting, grouting and curing as required.

PART 2 – PRODUCTS

2.01 MATERIALS

A. FILTER FABRIC: Shall meet the requirements of Mississippi Standard Specifications for Road and Bridge Construction, Latest Edition, Type V.

B. AGGREGATE FOR LOOSE OR GROUTED RIPRAP: Stone for random and grouted riprap shall consist of field stone, broken concrete (if approved by Engineer), or rough, unhewn quarry stone as nearly rectangular in section as is practicable. The stone shall be dense, free of clay or shale seams, resistant to the action of air and water, and suitable in all other respects for the purpose intended.

C. STONE SIZE: The stone for riprap shall meet the requirements of Section S-705.04 of the Mississippi Standard Specifications for State Aid Road and Bridge Construction.

D. CONCRETE: Portland cement concrete for slope paving shall conform to requirements of Section 033000.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. Prior to construction of riprap or slope paving, the slopes or ground surface shall be shaped to the lines and grades indicated on the plans or directed, and shall be thoroughly compacted by the use of mechanical or hand tamps.

B. Unless otherwise stipulated or directed, slopes shall not be steeper than the natural angle of repose of the material upon which the riprap is to be placed.

C. The outer edges of the top of the riprap or slope paving where the construction terminates shall be formed so that the surface of the riprap or slope paving will be embedded and even with the surface of the adjacent slope or ground, and the bottom of the riprap or slope paving shall be placed at least two feet below the natural ground surface unless otherwise directed.

D. All riprap or slope paving shall be started at the bottom of the slope and constructed upward.

E. No grout or slope paving shall be placed during freezing weather or while there is frost on the

ground. In hot weather grout shall be kept moist and protected from the sun for at least three days after placing. Slope paving shall be cured in accordance with requirements of Section 033000.

3.02 PLACING PLASTIC FILTER FABRIC: Place in accordance with the requirements of the Mississippi Standard Specifications for Road and Bridge Construction, Latest Edition.

3.03 LOOSE RIPRAP:

A. Stones shall be laid with close joints and placed upon a slope not steeper than the natural angle of repose.

B. The courses shall be laid from the bottom of the bank upward with the larger stones being placed in the lower courses.

C. Interstices shall be filled with smaller stones and spalls.

3.04 GROUTED RIPRAP

A. Grout for grouted riprap shall consist of one part of Portland cement and three parts of approved sand thoroughly mixed with water to produce grout having a thick, creamy consistency.

B. The stones shall be of the size designated in the bid schedule (proposal) of the contract and shall be placed in the same manner specified for loose riprap. Care shall be taken during placing to keep earth or sand from filling the spaces between the stones.

C. After the stones are in place, the spaces between them shall be completely filled with grout from bottom to top and the surface swept with a stiff broom.

3.05 SLOPE PAVING

A. Concrete slope paving shall be constructed in a single layer in conformity with the design dimensions and details indicated on the plans.

B. The concrete, placement of, finishing, curing, testing and all other aspects of the concrete installation shall conform to the requirements of Section 033000.

D. All edges shall be neatly edged using an approved edger.

PART 4 - COMPENSATION

4.01 GENERAL

A. Items which are not shown as separate pay items on the proposal form but are necessary for complete installation of the project in accordance with the Contract Documents shall be considered and absorbed cost and included in the Contract Price.

B. Scheduled price for each individual pay item shall constitute full compensation for furnishing all labor, tools, equipment and incidentals in performing all work necessary for complete installation in accordance with the Contract Documents of that pay item.

4.02 MEASUREMENT AND PAYMENT

A. LOOSE RIPRAP: Loose riprap complete in place and accepted will be measured and paid for in square yards or tons. The pay area will be determined by using the outside dimensions of the area covered per the drawings or as directed. Stone placed contrary to directions will not be paid for.

B. GROUTED RIPRAP: Grouted riprap complete in place and accepted will be measured and paid for in square yards or tons. The pay area will be determined by using the outside dimensions of the area covered per the drawings or as directed. Stone placed contrary to directions will not be paid for. Measurement or payment will not be made for grout and the cost therefore shall be included in the compensation for grouted riprap.

C. SLOPE PAVING: Slope paving will be measured and paid for in square yards or cubic yards computed using the dimensions shown on the plans except where authorized revisions are made in the finished grade or configuration of the slope pavement.

D. PLASTIC FILTER FABRIC: Plastic filter fabric will not be measured for payment. It will be considered an incidental items and shall be absorbed in the unit cost unless otherwise specified.

--END OF SECTION 313700--

# SECTION 321000 – CONCRETE CURBS AND WALKS

## PART 1 - GENERAL

### 1.01 DESCRIPTION OF WORK

The extent of concrete curbs and walks is shown on the drawings.

### 1.02 QUALITY ASSURANCE

Comply with local governing regulations, codes and standards if more stringent than herein specified.

## PART 2 – PRODUCTS

### 2.01 FORMS

A. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms to form radius bends as required.

B. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.

### 2.02 WELDED WIRE MESH

Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls, unless otherwise acceptable to the Engineer.

### 2.03 REINFORCING BARS

Deformed steel bars, ASTM A 615, Grade 40, unless otherwise indicated.

### 2.04 CONCRETE MATERIALS

Comply with requirements of Section 033000 for concrete materials, admixtures, bonding materials, curing materials, and others as required.

### 2.05 EXPANSION JOINTS MATERIALS

Comply with requirements of Section 033000 for pre-formed expansion joint fillers and sealers.

2. 06 CONCRETE MIX, DESIGN AND TESTING

A. Comply with requirements of Section 033000 for concrete mix design, sampling and testing, and quality control and as herein specified. Design the mix to produce standard weight concrete consisting of Portland cement, aggregate, air-entraining admixture and water to produce the following properties:

1. Compressive Strength: 3500 psi, minimum at 28 days, unless noted otherwise

2. Slump Range: 3" to 5"

3. Air Content: 5% to 8%

PART 3 – EXECUTION

3.01 INSPECTION

Examine areas and conditions under which concrete curbs and walks are to be installed; notify the Contractor in writing of conditions detrimental to proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.02 SURFACE PREPARATION

Remove loose material from the compacted sub-base surface immediately before placing concrete. Check for unstable areas and the need for additional compaction. Do not begin concrete work until such conditions have been corrected and are ready to receive concrete.

3.03 FORM CONSTRUCTION

A. Set forms to the required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement. Check completed formwork or grade and alignment to the following tolerances:

1. Top of forms not more than 1/8" in 10'.

2. Vertical face on longitudinal axis, not more than 1/4" in 10'.

B. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.04 REINFORCEMENT

Locate, place and support reinforcement as specified in Section 033000, unless otherwise indicated.

3.05 CONCRETE PLACEMENT

A. Comply with the requirements of Section 033000 for mixing and placing concrete, and as herein specified.

B. Do not place concrete until sub-base and forms have been checked for line and grade. Moisten sub-base if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete using methods which prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away form joint assemblies, reinforcement, or side forms. Use only square faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

3.06 JOINTS

Construction expansion and construction joints true-to-line with face perpendicular to surface of the concrete, unless otherwise indicated. Construct transverse joints at right angles to the center line, unless otherwise indicated. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar is free to move, as shown on drawings.

3.07 CONSTRUCTION JOINTS

Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such pours terminate at expansion joints. Construct joints as shown or, if not shown, use standard metal keyway-section forms.

3.08 EXPANSION JOINTS

A. Provide pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated. Locate expansion joints at 20' o.c. unless otherwise indicated.

C. Extend joint fillers full width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one piece lengths for the full width

being placed wherever possible.

C. Where more than one length is required, lace or clip joint filler sections together. Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

3.09 FILLERS AND SEALANTS

Comply with the requirements of Section 033000 of these specifications for preparation of joints, materials, installation, and performance, and as herein specified.

3.10 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compare the surface and produce a uniform texture. After floating, test surface for trueness with a 10' straight edge. Distribute concrete as required to remove surface irregularities, and re-float repaired areas to provide a continuous smooth finish.

B. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.

C. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows: Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Engineer.

D. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Engineer.

3.11 CURING

Protect and cure finished concrete, complying with applicable requirements of Section 033000. Use moist-curing methods for initial curing whenever possible.

3.12 REPAIRS AND PROTECTION

A. Repair or replace broken or defective concrete as directed by Engineer.

B. Protect concrete from damage until acceptance of work.

--END OF SECTION 321000--

# SECTION 32 1122 - AGGREGATE BASES

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Sub-grade preparation.

C. Testing rolling equipment and procedures.

D. Aggregate base course.

E. Coordination with earthwork specification.

F. All installations related to the above materials.

### 1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

2. ASTM D 75 - Standard Practice for Sampling Aggregates; 2009

3. ASTM D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction; 2012

4. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2007.

5. ASTM D 2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures; 2011.

6. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

### 1.3 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction.

All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

E. Grade Verification:

1. Refer to "Submittals" and "Field Quality Control" of this Section.

## 1.4 SUBMITTALS

A. Submit under the provisions of Division One Specifications.

1. Samples: Submit ten (10) pound (4.5 kg) sample of aggregate base course material to the Independent Testing Laboratory.

2. Certificates: The Contractor shall jointly provide certificates certifying that materials comply with the specification requirements.

B. The Contractor is to employ the services of a Registered Land Surveyor to perform the specified layout work and to prepare a grade verification survey. The grade verification shall be submitted prior to project close out.

## 1.5 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. Protection of Persons: Install barricade, as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may currently exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section. All repairs are part of the Base Bid Contract.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements. No additional compensation will be allowed to provide these services.

F. Grade Control: Establish and maintain the required lines and grades, including crown and cross slope, for each course during construction operations.

## 1.6 WARRANTY

A. Provide written warranty under the provisions of Division One Specifications.

B. Warranty: All materials and workmanship provided are guaranteed against defects after completion and final acceptance of the Work. Defects due to faulty materials or workmanship developed during the guarantee period shall be satisfactorily repaired or replaced by the Contractor at their expense.

# PART 2 EXECUTION

## 2.1 EXAMINATION

A. Examine the areas and conditions under which the Work of this Section will be performed. Correct conditions detrimental to the timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Verify substrate has been inspected, gradients and elevations are correct, and at suitable moisture content.

1. Do not proceed until unsatisfactory conditions have been corrected.

C. Coordinate with the related Earthwork specification to confirm that the sub-grade is at the proper elevation, densities, and material types. Proceeding with work indicates acceptance of the conditions constructed by the related specification section.

## 2.2 SUBGRADE PREPARATION

A. Correct irregularities in the substrate gradient and elevation by scarifying, reshaping, and recompacting.

B. Do not fill on soft, muddy, or frozen surfaces.

C. Remove loose and foreign material from compacted subbase surfaces immediately before paving application. Do not disturb subbase material.

## 2.3 TEST ROLLING SUBGRADE

A. Test rolling shall be used when verifying stability and uniformity of subgrade. This procedure shall be performed in presence of testing laboratory inspector.

B. Use test rolling equipment conforming to the following description:

1. Tandem axle, dual wheel dump truck.

2. Tire pressure shall be no less than 90 percent of manufacturer's recommended maximum inflation.

3. Minimum gross weight of loaded truck shall be 60,000 pounds.

4. Provide weigh slip to testing laboratory inspector.

C. Test Rolling Procedures shall be performed as follows:

1. Operate equipment at a rate not to exceed 3 to 5 mph or a comfortable walking pace.

2. Adjust speed to allow testing laboratory inspector to measure any deflections and areas of rutting.

3. Operate proof roller equipment in a pattern so that affected areas are loaded with at least one pass.

4. After proof rolling, check subgrade for conformance to drawings, and correct all surface irregularities. Re-shape subgrade within tolerances specified.

D. Limited access areas

1. The above description is typical for road and walk construction. Some areas use of a roller may be impractical, use largest compaction equipment that is practical under the observation of the soils testing representative.

E. Test Rolling Evaluation:

1. Rutting up to 1-inch is acceptable. Rutting in excess of 1-inch but not more than 6-inches shall be considered a failure and will require that soil be reworked and compacted to required density.

2. Deflection (pumping) up to 1-inch is acceptable. Deflection in excess of 1-inch but no more than 2-inches shall be acceptable if there is not substantial cracking or lateral movement of soil. Deflection in excess of 2-inches but not more than 6-inches shall be considered a failure, and will require that soil be reworked and compacted to required density.

3. Rutting and deflection in excess of 6-inches will require review and recommendation for corrective action by an approved Geotechnical Engineer.

4. After remedial work is performed, a final test roll shall be performed upon completion of work. If remedial work is performed as directed, a second test roll may be required at discretion of testing laboratory inspector.

## 2.4 AGGREGATE BASE PLACEMENT

A. Subgrade: The area to be paved shall be graded to the elevation of the underside of the stabilized base. Pre-compact soils beneath the stabilized base to percent recommended by geotechnical or civil engineer.

B. Remove all castings set by others that are within the paving area and replace with metal covers. The castings shall be reset as outlined in 321216 Asphalt Concrete Paving and 321313 Exterior Concrete Paving.

C. Spread aggregate base over prepared base to a total compacted thickness as indicated on the Drawings.

D. Place aggregate base in maximum three (3") inch layers and roller compact.

E. Level and contour surfaces to elevations and gradients indicated on the Drawings.

F. Compact placed aggregate materials to achieve compaction to 100 percent of its maximum dry density in accordance with ASTM D698.

G. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

H. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

I. Use mechanical vibrating tamping in areas inaccessible to compaction equipment.

J. Aggregate base shall be placed under the concrete curb and gutter by the Paving Contractor. Coordinate all work with the Exterior Concrete Pavement Contractor.

## 2.5 TOLERANCES

A. Flatness: Maximum variation of one-fourth (1/4") inch measured with a ten (10') foot straight edge.

B. Scheduled Compacted Thickness: Within one-fourth (1/4") inch.

C. Variation from True Elevation: Within one-fourth (1/4") inch.

## 2.6 FIELD QUALITY CONTROL

A. Field testing and inspection shall be performed by qualified parties as specified herein and in accordance with the provisions of Division One Specifications..

B. An Owner hired testing laboratory shall perform tests as indicated below.

1. Perform one sieve analysis on the aggregate base in accordance with ASTM C136 for every 1000 tons of aggregate base or a minimum of one test.

2. Visually field verify by test rolling and take two field density tests in accordance to ASTM D1556 or D2922 for every 250 tons of aggregate base placed or a minimum of four tests.

C. Grade Verification of Aggregate Base: A grade verification survey shall be performed after the aggregate base has been installed. This should be on the same grid system as specified in Section 31 0000 Earthwork "Field Quality Control". The surveyor shall issue a letter certifying that the grades are within the specified tolerances.

D. If tests indicate that the Work does not meet the specified requirements, remove the Work, replace and retest at no additional cost to the Owner.

END OF SECTION

# SECTION 32 1216 - ASPHALT CONCRETE PAVING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Asphalt concrete paving above aggregate base course; as indicated on the drawings, specified herein, and complete with all accessories.

C. Bituminous tack coat

D. Bituminous seal coat.

E. Asphalt concrete paving; wear course and non-wearing course surfaces.

1. Parking lot pavement.

2. Driveway pavement.

F. Paint striping and logos.

### 1.2 REFERENCES

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994, Sixth Edition.

B. American Society for Testing and Materials (ASTM):

1. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

2. ASTM D 2172 - Standard Test Methods for Quantitative Extraction of Bitumen From Bituminous Paving Mixtures; 2011.

3. ASTM D 2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures; 2011.

4. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

## 1.3 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

E. General: In addition to other specified conditions, comply with the following minimum requirements:

1. Subcontractor's Qualifications: The construction of bituminous paving shall be done by a responsible Paving Subcontractor having the necessary equipment, plant and experience to perform the work.

F. Grade Verification:

1. Refer to "Submittals" and "Field Quality Control" of this Section.

## 1.4 SUBMITTALS

A. Submit under the provisions of Division One Specifications.

1. Samples: Submit thirty-five (35) pound (4.5 kg) sample of asphalt concrete paving materials and asphalt mix design to the Independent Testing Laboratory.

2. Certificates: The Contractor and the Asphalt Concrete Producer shall jointly provide certificates certifying that materials comply with the specification requirements.

3. Job Mix Design: The bituminous mix plant shall have on file a report prepared by an approved testing laboratory that indicates the proportions of materials used in each type of bituminous courses being provided and the temperature of the mix. The job mix design shall be submitted to the Architect for acceptance prior to placing the bituminous mix.

B. The Contractor is to employ the services of a Registered Land Surveyor to perform the specified layout work and to prepare a grade verification survey. The grade verification shall be submitted prior to project close out.

## 1.5 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. Protection of Persons: The Owner's activities will continue about the site during construction. Install barricade as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may currently exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section. All repairs are part of the Base Bid Contract.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements. No additional compensation will be allowed to provide these services.

F. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

G. Weather Limitations:

1. Apply bituminous tack coat only when the ambient temperature is at least 50 degrees Fahrenheit (10 degrees C), and when the temperature has not been below 35 degrees Fahrenheit (2 degrees C) for twelve (12) hours immediately prior to application.

2. Do not apply materials when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.

3. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees Fahrenheit (4 degrees C), when the underlying base is dry and when weather is not rainy.

4. Refer to “Minimum Placement Temperature Chart” prepared by the National Asphalt Pavement Association for minimum bituminous placement temperatures.

5. Paving shall not take place when, in the opinion of the Independent Testing Laboratory, the weather or surface conditions are considered unfavorable.

## 1.6 MATERIAL REQUIREMENTS

A. Mix Criteria:

1. Provide mix formulas for each required asphalt-aggregate mixture.

2. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.

3. Maintain material quantities within allowable tolerances of the governing standards.

B. Prepare and keep on file the mix formula for each course.

C. The base course shall be tested and approved by the Independent Testing Laboratory immediately prior to placement of the asphalt concrete course.

D. The Contractor will be responsible for all drainage of the finish surface. Any “bird baths” will be considered unacceptable and shall be remedied by the Contractor at their expense to the satisfaction of the Architect.

## 1.7 SYSTEM DESCRIPTIONS

A. Design Requirements:

1. Heavy Duty Pavements: Per geotechnical report recommendations.

2. Light Duty Pavements: Per geotechnical report recommendations.

## 1.8 WARRANTY

A. Provide written warranty under the provisions of Division One Specifications.

B. Warranty: All materials and workmanship provided are guaranteed against defects after completion and final acceptance of the Work. Defects due to faulty materials or workmanship developed during the guarantee period shall be satisfactorily repaired or replaced by the Contractor at their expense.

# PART 2 PRODUCTS

## 2.1 SOURCE QUALITY CONTROL

A. Provide mix design for asphalt under the provisions of Division One Specifications.

B. Submit proposed mix design of each class of mix for review and approval prior to commencement of the Work.

C. Test samples in accordance with A1 MS-2.

## 2.2 PAVEMENT MARKING PAINT

A. Provide paint striping and handicap logos as indicated on the Drawings.

B. Provide paint specifically formulated for use as exterior pavement marking paint in traffic areas. Color is to be selected by Owner, Architect, and/or governing agency.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Examine the areas and conditions under which the Work of this Section will be performed. Correct conditions detrimental to the timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Coordinate with the related specification sections 31 0000 Earthwork and 33 1122 Aggregate Bases to confirm that the sub-grade is at the proper elevation, densities, and material types. Proceeding with work indicates acceptance of the conditions constructed by the related specification section.

## 3.2 SURFACE PREPARATION

A. Sub-grade

1. Reference related specification Section 31 0000

B. Aggregate Bases

1. Reference related specification Section 33 1122

C. Remove loose and foreign material from compacted subbase surfaces immediately before paving application. Do not disturb subbase material.

## 3.3 TACK COAT:

A. Apply to contact surfaces of previously constructed portland cement concrete surfaces and similar surfaces.

B. Apply at rate of five-hundredths (0.05) to fifteen-hundredths (0.15) gallons per square yard of surface.

C. Apply tack coat by brush to contact surfaces of concrete curbs, gutters, manholes and other structures projecting into or abutting asphalt concrete pavement.

D. Allow surfaces to dry until material is at condition of tackiness and ready to receive pavement.

3.4 PLACING THE MIX - DOUBLE COURSE

A. Place asphalt concrete mixture on prepared surfaces, spread and strike-off using paving machine.

B. Inaccessible and small areas may be placed by hand.

C. Place each course at thickness so that when compacted it will conform to the indicated grade, cross-section, finish thickness and density indicated.

D. Pavement Placing:

1. Unless otherwise directed, begin placing non-wear course at high side of section on one-way slope.

2. After first strip has been placed and rolled, place succeeding strips.

3. Complete non-wear courses for a section before placing wearing courses.

4. Place mixture in continuous operation as practicable.

5. Place tack coat before placing wear course.

6. Non-wear course shall be swept as required before placing wear course.

E. Hand Placed:

1. Spread, tamp and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to the Geotechnical Engineer.

2. Place mixture at a rate that will ensure handling and compaction before mixture becomes cooler than acceptable working temperature.

F. Joints:

1. Gradually make joints between old and new pavements, or between successive day's work, to ensure a continuous bond between adjoining work.

2. Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.

3. Clean contact surfaces free of sand, dirt or other objectionable material and apply tack coat.

4. Offset transverse joints in succeeding courses not less than five (5') feet.

5. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.

6. Offset longitudinal joints in succeeding courses no less than six (6") inches.

7. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory section to expose as even, vertical surface for the full course thickness.

## 3.5 COMPACTING THE MIX

A. Provide sufficient number of rollers to obtain the required pavement density of 95 percent of the recorded laboratory specimen density.

B. Begin rolling operations as soon after placing mix when the mixture will bear weight of roller without excessive displacement.

C. Do not permit heavy equipment, including rollers, to stand on finished surface before it has thoroughly cooled or set.

D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.

F. Do not roll centers of section first under any circumstances.

G. Breakdown Rolling:

1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.

2. Operate rollers as close as possible to the paving machine without causing pavement displacement.

3. Check crown, grade and smoothness after breakdown rolling.

4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

H. Second Rolling:

1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.

2. Continue second rolling until mixture has been thoroughly compacted.

I. Patching:

1. Remove and replace defective areas.

2. Cut-out and fill with fresh, hot asphalt concrete.

3. Compact by rolling to specified surface density and smoothness.

4. Remove deficient areas for full depth of course.

5. Cut sides perpendicular and parallel to direction of traffic with edges vertical.

6. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

## 3.6 MANHOLE AND GATE VALVE PROTECTION

A. Cover manholes, catch basins and gate valves lying within the surface to be sealed to as to prohibit the bituminous material from being placed thereon.

B. Clean the surface of these structures following the application of the cover aggregate.

## 3.7 ADJUSTING CASTINGS

A. Castings shall be raised after the bituminous base course is placed and prior to installing the wear course.

B. The bituminous base shall be saw cut around the cover plate. The bituminous aggregate and cover plate shall be removed.

C. The casting shall be set to final grade using adjusting rings and mortar. No blocks will be allowed.

D. The aggregate base shall be placed to the design depth around the casting. The bituminous patch mix shall be placed and tamped around the casting to bring the grade up to the surface of the bituminous base.

E. The final grade of castings in paved areas shall be one-fourth (1/4") inch to one-half (1/2") inch below the top of the completed wear course. The castings shall be set to the contour of the finished surface so that the required tolerance is uniform around the circumference of the casting. The one-fourth (1/4") inch to one-half (1/2") inch tolerance shall be measured at the immediate edge of the casting and no “straightedge” measurements shall be accepted. A plywood template, one-half (1/2") inch thick, shall be fastened to the top of all non-adjustable castings during placing and rolling of the wear course to ensure that the required tolerances are met.

F. All final adjustments to the adjustable castings shall be made by means of the casting adjustment bolts.

G. All castings, which do not meet the required tolerances, shall be removed and re-adjusted at the Contractor's expense.

## 3.8 TOLERANCES

A. Flatness: Maximum variation of one-fourth (1/4") inch measured with a ten (10') foot straight edge.

B. Scheduled Compacted Thickness: Within one-fourth (1/4") inch.

C. Variation from True Elevation: Within one-fourth (1/4") inch.

## 3.9 FIELD QUALITY CONTROL

A. Field testing and inspection shall be performed by qualified parties as specified herein and in accordance with the provisions of Division One Specifications.

B. A testing laboratory shall perform tests as indicated below.

1. Perform a minimum of one bituminous mix verification tests for each asphalt concrete layer in accordance with ASTM C136, ASTM D2172 and ASTM D2726.

2. Perform a minimum of one field density test on the bituminous paving by taking four (4") inch diameter core samples for every 200 tons or less of bituminous pavement per course to determine the thickness and field density of cores in accordance with ASTM D2726. For larger projects, perform a minimum of two tests for every 500 tons of bituminous pavement placed plus 2 tests every 500 tons thereafter.
    a. Density: Minimum acceptable density of in-place material is 95 percent of the recorded laboratory specimen density - Marshall Design.
        1) Asphalt paving densities below 95% may be accepted by owner. A reduction in payment and an extended warranty based upon failed test results may be negotiated with owner. Owner has option of removing all failing bituminous material and replacement at no additional cost to owner or owner's representatives.
    b. Thickness: The in-place compacted thickness of the bituminous cores will not be acceptable and will be cause for rejection and replacement of the bituminous pavement if exceeding the following allowable variation from thickness specified herein.
        1) Non-wear course: Plus or minus one-fourth (±1/4") inch.
        2) Wear course: Plus or minus one-fourth (±1/4") inch.
        3) The overall thickness of all lifts shall not be less than three-eighths (3/8") inch of the total thickness specified.
        4) The bituminous pavement thickness indicated is the minimum thickness. No additional payment will be given for pavement that exceeds the indicated thickness.
        5) Where the average thickness of the bituminous cores is more than or equal to one-half (1/2") inch less than the minimum indicated, the Owner may elect not to accept the bituminous pavement. If the pavement is accepted by

the Owner, payment will be at a reduced price that is proportional to the core thickness placed verse the minimum plan thickness indicated and will require a negotiated Owner/Contractor extended warranty.

c. Repair holes from test specimens as specified for patching defective work.

C. Surface Smoothness:

1. The Contractor shall provide final surfaces of uniform texture, conforming to the required grades and cross-sections. Visually observe surface smoothness of finished surface. The finished surface shall be free of segregated, open and torn sections and shall be smooth and true to grade and cross section as shown on the Drawings.

2. Test finished surface of each asphalt concrete course for smoothness, using a ten (10') foot straightedge applied parallel to and at right angles in centerline of paved areas.

3. Check surfaced areas at intervals as directed by the Geotechnical Engineer.

4. Surfaces will not be acceptable if exceeding the following:
   a. Base Course: One-fourth (1/4") inch in ten (10') feet.
   b. Surface Course: Three-sixteenth (3/16") inch in ten (10') feet.

D. Flood Test:

1. After completion, flood the entire asphalt concrete paved area with water by use of a tank truck or hoses.

2. If a depression is found where water ponds to a depth of more than one-eighth (1/8") inch in six (6') feet, fill areas or otherwise correct to provide proper drainage.

3. Feather and smooth the edges of fill so that the joint between the fill and the original surface is invisible.

E. Grade Verification of Bituminous Pavement: A grade verification survey shall be performed after the final lift of bituminous pavement has been completed. This will be on the same grid system as specified in Section 33 1122 Aggregate Bases "Field Quality Control". The surveyor shall issue a letter certifying that the grades are within the specified tolerances.

F. If tests indicate that the Work does not meet the specified requirements, remove the Work, replace and retest at no additional cost to the Owner.

## 3.10 LANE STRIPING AND HANDICAPPED MARKINGS

A. Lane and parking lot striping shall not be performed until the excess oils in the new asphalt paving have dissipated, allowing a better bond between the paint and asphalt pavement. The Contractor shall wait 3 to 4 weeks after the asphalt pavement has been installed before placing the striping.

B. Cleaning: Sweep the surface with a power broom, supplemented by hand brooms, to remove loose material and dirt.

C. Markings: The lines shall be four (4”) inches wide. Paint the International Wheelchair Symbol of Accessibility in each handicapped parking stall. The painted symbol on the pavement shall be in accordance with the state code requirements.

D. Application: Apply the paint with mechanical equipment. Provide uniform straight edges. Apply two (2) separate coats in accordance with the manufacturer's recommended rates.

## 3.11 CLEANING

A. After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the Architect.

B. When marking paint is thoroughly dry, visually inspect the entire applications, and:

1. Touch up paint as required to provide clean, straight lines and surfaces throughout.

2. Using a permanently opaque paint identical in color to the surface on which the paint was applied, block out and eliminate all traces of splashed, tracked and/or spilled pavement marking paint from the background surfaces.

## 3.12 PROTECTION

A. The Contractor shall be required to protect all adjacent concrete surfaces from chipping and damage during the asphalt pavement placement.

B. Protect all concrete surfaces from staining or discoloration during placement of asphalt materials or vehicle trucking during construction.

C. Immediately after placement of asphalt paving, provide traffic cones, barricades and other devices needed to protect pavement and marking paint from mechanical injury for a minimum of seven (7) days.

END OF SECTION

# SECTION 32 1313 - EXTERIOR CONCRETE PAVING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Exterior concrete pavement systems above base course; as indicated on the Drawings, specified herein, and complete with all accessories.

C. Granular base under exterior concrete sidewalk Work is specified under the provisions of Section 31 0000.

D. Exterior Concrete Work:

1. Concrete curb and gutter.

2. Aprons and Driveway slabs.

3. Sidewalks.

4. Concrete pavement.

5. Slabs for trash dumpsters.

6. Pedestrian curb ramps.

7. Slabs for transformer pads.

### 1.2 REFERENCES

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

C. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

D. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

E. ACI 308R - Guide to Curing Concrete; 2001(Reapproved 2008).

F. ACI 309R - Guide for Consolidation of Concrete, American Concrete Institute; 2005.

G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2008.

H. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2010.

I. ASTM C 33 - Standard Specification for Concrete Aggregates; 2011.

J. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2012.

K. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2012.

L. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate; 2006.

M. ASTM C 143/C 143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2010a.

N. ASTM C 150 - Standard Specification for Portland Cement; 2011.

O. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 1999 (2008).

P. ASTM C 1116 - Standard Specification for Fiber-Reinforced Concrete; 2010a.

## 1.3 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

E. Perform the Work in accordance with ACI 301 and ACI 318.

F. Acquire cement and aggregate from same source for all Work.

G. The complete exterior concrete Work shall give the appearance of uniformity in surface contour and texture and shall be accurately constructed to line and grade. The required joints shall show neat workmanship.

H. Quality Control:

1. Do not commence placement of concrete until mix design has been reviewed and approved by the Architect/Engineer and until copies are at the jobsite, the batch plant and the building inspection department.

I. Grade Verification:

1. Refer to "Submittals" and Field Quality Control" of this Section.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Submit under the provisions of Division One Specifications.

1. Delivery Tickets: Submit one copy to Architect indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump and time of batching for each load delivered.

2. Product Data: Provide manufacturer's data on joint filler and curing compounds.

3. Test Reports and Mix Designs: Contractor shall submit mix designs and aggregate test reports, directly from testing laboratory. Submit mix designs and aggregate test reports at least 14 days prior to placing. Do not place concrete until the Architect/Engineer has reviewed mix designs and aggregate test reports. Mix identification designation.

C. The independent testing laboratory will submit concrete compression tests, entrained air test, and slump test reports.

D. The contractor is to employ the services of a Registered Land Surveyor to perform the specified layout work and to prepare a grade verification survey. The grade verification shall be submitted prior to project close out.

1.5 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. Protection of Persons: The Owner's activities will continue about the site during construction. Install barricade fencing (snow fence), as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may currently exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements. No additional compensation will be allowed to provide these services.

F. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.

G. Cold Weather Protection: Place and protect concrete in accordance with ACI 306, and the following:

1. When mean daily temperature is 40ºF or lower, provide suitable protection for concrete work as required to maintain minimum concrete temperature of 50ºF for five (5) days, or 70ºF for three (3) days.
   a. So as to avoid thermal shock to the finished work, following protection period, do not allow concrete to cool more than 20ºF each successive day.

H. Hot Weather Protection: Place and protect concrete in accordance with ACI 305. Employ suitable means to prevent too-rapid drying. Shade fresh concrete as soon as is possible without marring surface.

I. Wet Weather Protection: Do not place concrete in rain, sleet, or snow, without providing adequate protection.

## 1.6 DELIVERY STORAGE AND HANDLING

A. Furnish delivery tickets with each load of concrete delivered to the Project. Information on each ticket shall be as follows:

1. Name of ready-mix batch plant.

2. Ticket number

3. Date.

4. Truck number.

5. Project name and location.

6. Type of concrete (mix number).

7. Amount of concrete.

8. Weights of all ingredients.

9. Time loaded or time of first mixing.

10. Maximum aggregate size.

11. Type, brand, and amount of admixtures.

12. Total water in the batch and maximum amount of water that can be added at the site without exceeding design mix proportions.

13. Amount of water added at site and initials of person adding water.

B. The Contractor shall retain delivery tickets for the duration of construction.

1.7 FIELD MEASUREMENTS

A. Verify actual locations of exterior concrete work and other construction to which concrete work must fit, by accurate field measurements before installation. Show recorded measurements on final Shop Drawings. Coordinate installation schedule with construction progress to avoid delay of the Work.

B. The Contractor is to employ the services of a registered land surveyor to perform the specified layout work.

1.8 WARRANTY

A. Provide written warranty under the provisions of Division One Specifications.

B. Warranty: All materials and workmanship provided are guaranteed against defects after completion and final acceptance of the Work. Defects due to faulty materials or workmanship developed during the guarantee period shall be satisfactorily required or replaced by the Contractor at their expense.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

A. The forms shall be of metal, wood or other suitable material, and shall be capable of sustaining the concrete in its proper position until set. Do not use aluminum materials in contact with concrete. Concrete form materials must be used in a manner to provide the surface finish specified.

B. Form Coating Material: Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.

C. Side forms shall have a height at least equal to the edge thickness of concrete being formed.

D. Flexible or curved forms shall be used on curves having a radius of 150 feet or less.

E. Face forms for curbing shall conform to the shape and design of the curb.

### 2.2 SOURCE QUALITY CONTROL

A. Provide concrete mix design under the provisions of Division One Specifications

B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.

C. Provide an independent testing laboratory to perform the following:

1. At the beginning of the concrete operations for the project and for each 1,000 yards of concrete delivered to the project, test the fine and coarse aggregate gradation in accordance with ASTM C136 for conformance with this specification.

2. Verify that the concrete supplied meets the mix design requirements.

3. Submit test results to the Architect/Engineer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

A. Examine the areas and conditions under which the Work of this Section will be performed. Correct conditions detrimental to the timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Coordinate with the related specification sections 31 0000 Earthwork and 33 1122 Aggregate Bases to confirm that sub-grade, granular base, and aggregate base is at the proper elevation, densities, and material types. Proceeding with work indicates acceptance of the conditions constructed by the related specification section.

## 3.2 SURFACE PREPARATION

A. Sub-grade

1. Reference related specification Section 31 0000

B. Aggregate Bases

1. Reference related specification Section 33 1122

C. Base Placement

1. Spread granular cushion as specified in Section 31 0000 over prepared base to a total compacted thickness as indicated on the Drawings.

2. Place granular cushion base in maximum three (3") inch layers and roller compact.

3. Level and contour surfaces to elevations and gradients indicated on the Drawings.

4. Compact placed aggregate materials to achieve compaction to 100 percent of its maximum dry density in accordance with ASTM D698.

5. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

6. Use mechanical vibrating tamping in areas inaccessible to compaction equipment.

D. Remove loose and foreign material from compacted subbase surfaces immediately before paving application. Do not disturb subbase material.

E. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

F. The Contractor shall notify the Architect/Engineer and the Independent Inspection Agency a minimum of forty-eight (48) hours prior to commencement of concreting operations.

## 3.3 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

D. Install forms to allow continuous progress of Work and so that forms can remain in place at least twenty-four (24) hours after concrete placement.

E. Slipform equipment may be used if the resulting curb and gutter conforms to the shape as specified on the drawings and the finish is satisfactory to the Architect/Engineer.

3.4 JOINTING

A. Expansion Joints: Joints shall be filled with one-half (1/2") inch thick pre-formed joint filler material and shall be installed in the sidewalk at the following locations:

1. At the beginning and end of all curved sections.

2. Where all new concrete surrounds, adjoins or abuts any existing fixed objects, such as fire hydrants, valve boxes, manholes, light poles, flag poles, curbs, walks or other rigid structures.

3. At sixty (60') foot maximum spacing or as indicated on the drawings.

B. Contraction Joints: Curbing shall be provided with contraction joints at ten (10') feet on center or as indicated on the Drawings.

C. General: All joints shall be vertical and straight. Transverse joints shall be placed at right angles to the longitudinal axis of the Work. Joints shall align with similar joints in adjoining work where practical.

D. The panels shall be square where practicable and generally have not more than 36 square feet of area.

E. The joints shall align with like joints in adjoining work unless the work is isolated by ½ inch isolation joints.

F. All joint work shall coordinate precisely with grids, modules and radials as prescribed on the Drawings.

G. All joints and edges of walk shall be rounded with a 1/8-inch radius tool.

H. Contraction joints shall extend to at least 1/3 the walk thickness and shall be approximately 1/8 inch wide.

I. Expansion and isolation joints shall be ½ inch wide and shall be equal in depth to the full thickness of the slab.

3.5 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 and comply with the requirements for mixing and placing concrete as herein specified.

B. Ensure reinforcement, inserts, embedded parts and formed joints are not disturbed during concrete placement.

C. Immediately before concrete placement, dampen base to reduce absorption. Standing water will not be permitted.

D. Do not place concrete on frozen ground.

E. Incorporate all concrete admixtures into the concrete at the ready-mix plant.

F. Reject concrete not placed within 90 minutes of initial mix.

G. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

H. Place concrete to pattern indicated on the Drawings or as directed by the Architect/Engineer.

I. Place concrete by methods that prevent segregation of the mix. Consolidate concrete along the face of the forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement and side forms.

J. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

## 3.6 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth surfaces by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating and before final finishing, check the concrete with a ten (10') foot steel straightedge to ensure there is no variation greater than three-sixteenth (3/16") inch from the straightedge.

C. Work edges of slabs, gutters top edge of back of curbs and formed joints with an edging tool, and round to one--half (1/2") inch radius, unless otherwise indicated. Eliminate tool marks on concrete surfaces.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surfaces as follows:

1. Sidewalks: Light broom, radius edges to one (1") inch and trowel joint edges.

2. Curb and Gutters: Light broom.

3. Straight Curbs: Light broom, radius edges to one (1”) inch and trowel joint edges.

4. Stair Steps: Light broom.

5. Inclined Ramps: Light broom perpendicular to slope.

6. Pavements: Light broom.

## 3.7 CONCRETE CURING

A. Unformed Surfaces: Apply curing materials as soon as finishing operations are complete and the concrete's sufficiently hard to be undamaged by the curing process.

1. Waterproof paper or polyethylene film: Use appropriate color of film based on ambient temperature. Sprinkle concrete with water as necessary during application of covering. Lap edges and ends at least 6 inches, and seal laps. Weight down covering to prevent movement. Patch holes and tears that occur during the curing period.

B. Compound Application:

1. Apply a membrane-curing compound to the exposed surface of the concrete within one (1) hour of finishing the concrete.

2. The compound shall be thoroughly mixed before it is applied.

3. If forms are removed in less than seventy-two (72) hours after placing the concrete, the curing compound shall be applied immediately to the exposed surfaces.

4. The curing compound shall be applied by an approved airless spraying machine at the approximate rate of one (1) gallon of compound to 150 square feet of surface curing area.

5. In all cases, the Contractor shall be responsible for the protection of the concrete from frost during the cure period.

C. The Architect/Engineer will shut down concrete placement if the operations are not being carried out according to these specifications.

## 3.8 FIELD QUALITY CONTROL

A. Field testing and inspection shall be performed by qualified parties as specified herein and in accordance with the provisions of Division One Specifications:

1. Compressive Test Specimens:
   a. Make one set of test cylinders (four per set), per ASTM C31, for each day's pour in excess of one cubic yard for each type of concrete. If day's pour exceeds 25 cubic yards, make one set of test cylinders for each additional 50 cubic yards or fraction thereof. Mold and store cylinders for laboratory cured specimens.

2. Compressive Strength Tests:
   a. Test cylinders per ASTM C39. Testing shall be performed by independent testing lab. One specimen shall be tested at 7 days for information and two cylinders shall be tested at 28 days for acceptance. One specimen shall be retained in reserve for later testing if required.

3. Slump Tests:
   a. Furnish and maintain a slump cone and tamping rod. Test first batch of each type of concrete delivered for each day's pour, plus one test for each 25 cubic yards or fraction thereof, ASTM C143.

4. Entrained Air Tests:

a. Furnish and maintain a properly calibrated pressure-type air meter. Test first batch of air entrained concrete delivered for each day's pour plus one test for each 50 cubic yards or fraction thereof, ASTM C231.

5. Sidewalks, paths and walkways shall meet ADA accessibility standards. Replacement of walks is required if over 5 percent longitudinal grade, over 2 percent cross slope, over 2 percent at 90 degree changes in direction (landings) and 1 percent within 5 feet of a building entrance.
   a. Grade Verification of Exterior Walks: A grade verification survey shall be performed after all walks are installed to assure ADA accessibility standards has been satisfied.

B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature and test samples taken.

## 3.9 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures and mechanical injury.

END OF SECTION

# SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

## PART 1 - GENERAL

### 1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.

### 1.2 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, Samples of all materials that will contact or affect joint sealants. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

### 1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Pavement-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Product certificates.

E. Product test reports.

F. Preconstruction compatibility and adhesion test reports.

### 1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021.

B. Preinstallation Conference: Conduct conference at Project site.

PART 2 - PRODUCTS

## 2.1 MATERIALS

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Crafco Inc., an ERGON company; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Pecora Corporation; 301 NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Crafco Inc., an ERGON company; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Pecora Corporation; 300 SL.

C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant for Concrete: ASTM C 920, Type M, Grade P, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide the following:

a. Pecora Corporation; Urexpan NR-200.

## 2.3 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant for Concrete: ASTM D 3406.

1. Products: Subject to compliance with requirements, provide the following:

a. Crafco Inc., an ERGON company; Superseal 444/777.

B. Hot-Applied, Single-Component Joint Sealant for Concrete and Asphalt: ASTM D 6690, Types I, II, and III.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Meadows, W. R., Inc.; Sealtight Hi-Spec.
b. Right Pointe; D-3405 Hot Applied Sealant.

## 2.4 JOINT-SEALANT BACKER MATERIALS

A. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

## 2.5 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Cleaning of Joints: Clean out joints immediately before installing joint sealants.

C. Install joint-sealant backings of kind indicated to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

D. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

E. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 321373

SECTION 329223 – SOLID SODDING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK: The work required under this Section will consist of furnishing and planting Bermuda grass sod or other approved grass sod to provide complete cover of solid turf having satisfactory growth on all areas shown on the Plans or as designated by the Engineer to be solid sod. Such areas may include ditches, side slopes, back slopes, berms, shoulders, islands, lawns and other designated areas.

PART 2 – PRODUCTS

2.01 SOD

A. Solid sod shall be native Bermuda (common) or other approved species and shall be live, fresh, growing grass with at least one and one-half inches of soil adhering firmly to the roots when placed. The sod shall be reasonably free from obnoxious weeds or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. The sod shall be in blocks at least 1’ x 1’ x 2” and reasonably free from ragged edges.

B. All sod shall be procured from areas where topsoil is fertile. Such areas shall have been sufficiently grazed or mowed to from a dense turf. After approval, the area from which the sod is to harvested shall be closely mowed and raked to remove excessive top growth and debris.

2.02 FERTILIZER: Fertilizer used shall be in accordance with Section 320190.13.

PART 3 – EXECUTION

3.01 PROCURING AND HANDLING SOD

A. Approved mechanical devices shall be used for cutting the sod into strips or blocks. Care shall be exercised at all times to retain the native soil on the roots of the sod during the process of excavating, hauling and planting.

B. The sod blocks or strips shall be transplanted within twenty-four hours from the time of cutting unless they are stacked in a manner satisfactory to the Engineer. All sod in stacks shall be kept moist and protected from exposure to wind, sun and freezing.

B. In no event shall more than three days elapse between the cutting and planting of the sod.

3.02 GRADING OF THE AREA TO RECEIVE SOLID SODDING

A. Prior to ground preparation for solid sodding upon any area, all excavating, shaping and dressing of such area shall have been completed in such a manner that the foundation for the sod will have the proper cross section, line and grade. Contractor is to take into account the thickness of the native soil attached to the sod in his grading work to where the sod placement will tie at proper elevation to all structures that will promote positive drainage. After placement, the sod will be flush with or slightly below the adjacent final ground line or structures.

3.03 GROUND PREPARATION

A. Ground preparation shall consist of plowing or disk-harrowing and thoroughly pulverizing the area to designated to receive solid sodding to a depth of approximately four inches.

B. Aeration, moistening or otherwise bringing the soil to a suitable condition to receive ground preparation shall be considered as incidental to the Work and will not be measured for separate payment. Areas not containing satisfactory moisture will not be approved by the Engineer for planting.

3.04 FERTILIZING: The specified amount of fertilizer shall then be uniformly applied over the surface and raked or harrowed lightly to incorporate it into the prepared soil. After approval by the Engineer of the prepared and fertilized area, sodding shall immediately follow.

3.05 PLANTING SOD: The sod shall be placed on the prepared surface with the edges in close contact starting at the lowest point and working upward. All cracks between blocks or rolls of sod shall be closed with small pieces of fresh sod cut to fit. All cracks to small for sod shall receive a light dressing of approved soil. The entire sodding area shall then be compacted with a light roller, hand tamper or other approved equipment and then watered to the satisfaction of the Engineer.

3.06 LIMITATIONS: Solid sodding shall be performed only when the weather and soil conditions are suitable for proper placement of sod.

3.07 PLANT ESTABLISHMENT

A. Plant establishment shall consist of preserving, protecting, replacing, watering, mowing and such other work which may be deemed necessary to keep the sod in satisfactory condition at all times until final acceptance.

B. The Contractor shall be responsible for the establishment of a satisfactory growth of grass. The Contractor shall water the sod as needed to promote healthy living and growing sod turf.

C. A satisfactory growth of solid sodding shall be understood to mean a healthy, living and growing grass turf which has been planted on an approved prepared foundation and established in accordance with the requirements of these specifications. Solid sodding so planted and established (which is determined to be dormant at the time of final inspection) will not be expected to show evidence of growing at the time.

PART 4 – METHOD OF MEASUREMENT AND PAYMENT

4.01 GENERAL

No separate payment shall be made for any item necessary for the completion of the work indicated on the Contract Drawings and in the Specifications but not shown as a pay item on the proposal form; therefore, full compensation for these items shall be considered absorbed in the Contract Lump Sum or related pay items.

4.02 MEASUREMENT AND PAYMENT

A. SOLID SOD: Solid Sod shall be measured and paid for at the Contract Unit Price bid per square yard which shall be full compensation for all trenching out, fine grading, ground preparation, for seating the solid sod to the specified location, for backfilling and disposal of surplus materials, for furnishing transporting and planting the sod, for replanting as deemed necessary, for furnishing water and watering, for all other materials, equipment tools, labor and incidentals necessary to complete the work.

--END OF SECTION 329223--

# SECTION 33 1000 - WATER DISTRIBUTION

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Water distribution system for domestic consumption and firefighting as indicated on the drawings, herein specified and required for a complete and proper installation.

### 1.2 REFERENCES

A. National Fire Protection Association (NFPA) - Chapter 24, “Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2010.

B. AWWA B300 - Hypochlorites; American Water Works Association; 2010 (ANSI/AWWA B300).

C. AWWA B301 - Liquid Chlorine; American Water Works Association; 2010 (ANSI/AWWA B301).

D. AWWA C651 - Disinfecting Water Mains; 2005 (ANSI/AWWA C651).

### 1.3 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

E. Construction of water main and building service pipelines utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of potable water. Relocation or adjustment of existing facilities as may be indicated on the Drawings.

F. All references to Cast Iron material shall be construed to include both Gray Iron and Ductile Iron products, except where one or the other is specified. All references to “structure” shall

include any man-made object that is not otherwise exempted by special terminology or definition.

G. Regulatory Requirements:

1. Local Codes and Ordinances.

2. Local Authority having Jurisdiction.

H. The Contractor is to employ the services of a Registered Land Surveyor to perform the specified layout work.

I. Perform Work in accordance with governing agency requirements.

## 1.4 FIELD MEASUREMENTS

A. Verify actual locations of water distribution systems with other construction in which water distribution systems must fit by accurate field measurements before installation. Coordinate installation schedule with construction progress to avoid delay of the Work. No additional compensation will be given for problems resulting from Contractor's failure to verify and/or coordinate storm sewer work.

## 1.5 SUBMITTALS

A. Submit under the provisions of Division One Specifications.

B. Shop Drawings: The Contractor shall submit a Shop Drawing portfolio showing all piping, valves, fittings, accessories, etc. provided under this Section prior to construction.

C. Record Drawings: The Contractor is to retain the services of a Registered Land Surveyor to prepare a utility verification survey. The record drawing shall be submitted prior to project closeout. Refer to Part Field Quality Control of this specification section.

1. After the date of Substantial Completion and prior to the release of retainage, the Record Drawings shall be transmitted to the Architect.

D. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe discovery of uncharted utilities.

E. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

## 1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

1.7 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. Protection of Persons: The Owner's activities will continue about the site during construction. Install barricade fencing (snow fence), as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements.

1.8 CONFLICTING UTILITIES

A. Remove and/or relay conflicting utilities, when so directed by the Architect, at the expense of the Owner.

B. When alterations to existing utilities are shown to avoid conflicts, make alterations at no cost to the Owner.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect products to the site under the provisions of Division One Specifications.

B. Deliver new packaged materials, well-marked and identified, clean, dry and protected against dampness, freezing and damage.

C. Avoid severe impact blows, gouging or cutting by metal surfaces or rocks.

1.10 WARRANTY

A. Provide written warranty under the provisions of Division One Specifications.

B. Warranty: All materials and workmanship provided are guaranteed against defects after completion and final acceptance of the Work. Defects due to faulty materials or workmanship developed during the guarantee period shall be satisfactorily repaired or replaced by the Contractor at their expense.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials required for this Work shall be new material conforming to the requirements of the referenced Specifications for the class, kind, type, size, grade and other details indicated in these Specifications. Unless otherwise indicated, all required materials shall be furnished by the Contractor. If any options are provided for, as to type, grade, or design of the material, the choice shall be limited as may be stipulated in the Plans and Specifications.

B. Manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Plans. Otherwise, the Architect may require advance approval of material suppliers, product design or other unspecified details as he deems desirable for maintaining adopted standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.2 INSPECTION AND RESPONSIBILITY OF MATERIALS

A. During the process of unloading, the Contractor shall inspect all pipe and accessories for damage. Notify the Architect of all material found that has cracks, flaws or other defects. The Architect shall inspect the damaged material and have the right to reject any materials he/she finds unsatisfactory. Promptly remove all rejected material from the site.

B. Pipe and other accessories shall, unless otherwise directed by the Architect, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the Contractor. They shall at all times be handled with care to avoid damage.

C. The Contractor shall be responsible for all material furnished and shall replace at their own expense all such material that is found to be defective in manufacture or that has become damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work.

D. The Contractor's responsibility for material furnished by the Owner shall begin at the point of delivery by the manufacturer, or Owner, and upon acceptance of the material by the Contractor. The Contractor shall examine all material furnished by the Owner at the time and place of delivery, and shall reject all defective material.

E. The Contractor at their own expense shall replace any material furnished by the Owner that becomes damaged after acceptance by the Contractor.

F. The Contractor shall be responsible for the safe storage of material furnished by or to him/her, and accepted by him/her, and intended for the Work until it has been incorporated in the completed project.

## 3.3 REMOVALS, TRENCH EXCAVATION AND BACKFILL AND RESTORATION

A. Removal of existing facilities, trench excavation and backfill and restoration shall be in accordance with the provisions of Section 31 2333.

## 3.4 WATER MAIN PIPE LAYING OPERATIONS

A. Prior to start of water main construction, the Contractor is to verify with the Building Mechanical Contractor the exact location and elevation at the building. No additional compensation will be allowed for work not coordinated.

B. A registered Land Surveyor employed by the Contractor shall perform the primary line and grade. No deviation from the required line or grade will be allowed except with the consent of the Architect.

C. Trench excavation and bedding preparations shall precede ahead of the pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Every reasonable precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed in the line. The water main materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

D. Before being lowered into laying position, the Contractor shall make a thorough visual inspection of each pipe section and appurtenant units to detect damage, foreign matter needing removal or unsound conditions that may need corrective action or be the cause for rejection. Inspection procedure shall be as approved by the Architect, with special methods being required as he deems necessary to check out suspected defects more definitely. The Contractor shall

inform the Architect of any defects discovered and the Architect will prescribe the required corrective actions or order rejection and prompt removal from the site.

E. Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections, and any imperfections so detected shall be corrected by cleaning, trimming, or repair as needed.

F. At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate. No pipe material shall be laid in water or when the trench or bedding conditions are otherwise unsuitable or improper. Unless otherwise permitted by the Architect, bell and spigot pipe shall be laid with the bell end facing upgrade and the laying shall start at the downgrade end, proceeding upgrade.

G. When placement or handling precautions prove inadequate, in the Architect's opinion, the Contractor shall provide and install suitable plugs or a cap effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

H. As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to the correct line and grade. The pipe shall be securely in place with approved backfill material, which shall be thoroughly compacted around the pipe. The joint areas shall remain exposed and precautions shall be taken to prevent the soil from entering the joint space, until the joint seal has been established. All valve stems and hydrant barrels shall be plumb.

I. All openings along the line of the water main shall be securely closed, as directed, and at the suspension of work at any time, suitable stops shall be placed to prevent earth or any substances from entering the water main. If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

J. The water main shall generally be placed below the typical frost line and/or per governing agencies code; However, a slightly greater depth may be required to clear existing storm and sanitary sewer services. Accordingly, the pipe will be laid to the depth substantially as shown on the plans. Minor adjustments to this may be required in the field, and no unit of measurement or payment shall apply for such variation.

K. In certain locations where the water main is in direct conflict with the storm or sanitary sewer, the water main shall be constructed under the sewer. Where it is necessary to use vertical bends to avoid sewer mains, no extra compensation will be made for this construction.

L. Water mains crossing storm sewers or sanitary sewers shall be laid to provide a separation of at least eighteen (18") inches between the bottom of the water main and the top of the sewer. When local conditions prevent a vertical separation as described, the following construction shall be used:

1. Sewers passing over or under water mains shall be constructed of materials equal to water main standards of construction.

2. Water main passing under sewers shall, in addition, be protected by providing:

a. A vertical separation of at least eighteen (18") inches between the bottom of the sewer and the top of the water main;
b. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking of the water mains;
c. That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

M. Water mains shall be laid horizontally from any sanitary sewer, storm sewer or sewer manhole, per local, state, and governing agency requirements.

N. The Contractor shall not operate any valve or other control on the existing system for any purpose without approval by the owner of the existing system.

O. Coordinate with water main utility owner when it is necessary to take a water main out of service.

P. Where pipe cannot be placed by open trench excavation, the method for placing shall be approved by the Architect.

## 3.5 FIELD QUALITY CONTROL

A. Record Drawings: The Contractor shall retain the services of a Registered Land Surveyor to prepare a utility verification survey as required in Section 33 1000 - Submittals. The surveyor shall check the following:

1. Horizontal and vertical verification of water main and appurtenances.

2. The surveyor shall supply a reproducible record drawing and an AutoCAD compatible record drawing.

B. Field inspection testing and compaction testing shall be performed in accordance with the Specifications.

C. If tests indicate that the Work does not meet the specified requirements, remove the Work, replace and re-test at no cost to the Owner.

## 3.6 METHODS OF TESTING AND DISINFECTION

A. The Contractor shall perform all testing and disinfecting in the Architect's presence.

B. Hydrostatic Pressure Test:

1. Before a new water main can be filled for testing, or flushing, notice must be given to the water utility owner.

2. After the pipe has been laid including fittings, services, valves and hydrants, and the line has been backfilled in accordance with these Specifications, all newly laid pipe, or any valved section thereof including building services unless otherwise directed by the Architect, shall be subjected to a hydrostatic pressure test.

3. Each isolated section of pipe shall be slowly filled with water. The specified test pressure, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges and the Contractor shall furnish all necessary apparatus. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation and afterward tightly plugged.

4. The test pressure shall be brought to one hundred fifty (150psi) pounds per square inch for domestic water services and two hundred (200 psi) pounds per square inch for fire services. Thereafter, the test shall be considered satisfactory if without additional water, the pressure remains constant for a period of two (2) hours at the specified pressure. The maximum pressure drop allowed for a domestic water service is two (2 psi) pounds per square inch during the last hour of the two hour test. The maximum pressure drop allowed for a fire service is five (5 psi) pounds per square inch during the last hour of the two hour test.

5. Any cracked or defective pipes, fittings, valves or hydrants discovered due to the consequence of the pressure test shall be removed and replaced by the Contractor and the test shall be repeated until satisfactory to the Architect. All costs for removing, replacing and re-testing are considered part of the Base Bid Contract.

C. Disinfection of Water Mains:

1. General: All pipe lines installed shall be disinfected per governing agency standards and specifications.

2. Flushing: The pipeline shall be flushed at a velocity of at least two and one-half (2-1/2') feet per second immediately prior to disinfection. Notice is required to the water main owner for pipeline flushing.

3. Disinfectants: Disinfection shall be performed using either chlorine gas or calcium hypochlorite solution. Chlorine gas shall conform to AWWA B301 and shall be handled under pressure as an aqueous solution. Calcium hypochlorite shall conform to AWWA B300 and shall be granules with 70 percent available chlorine.

4. Feeding: Chlorine gas shall be used only as a solution. Introduction of chlorine gas into the pipeline directly will not be permitted. When chlorine is used, a chlorinator and booster pump with injector shall be provided.

5. During disinfection all valves and hydrants shall be operated to ensure that all appurtenances are disinfected.

D. Bacteriological Tests:

1. Bacteriological testing of the water main shall be performed according to governing agency standards and specifications.

2. Following disinfection and final flushing and before the new main is connected to the distribution system, samples are to be taken per governing agency standards.

3. Repeat Testing: If initial disinfection fails to produce satisfactory bacteriological samples, the disinfection shall be repeated until satisfactory bacteriological samples are obtained. Costs for additional disinfection shall be borne by the Contractor.

4. Inspection: a qualified Inspector furnished by the City or Owner shall supervise the above operation. The City or Owner shall have at least a “48” hour notice for said inspection.

END OF SECTION

# SECTION 33 3000 - SANITARY SEWERAGE UTILITIES

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Site sanitary sewerage construction to within five feet from building. Municipal sanitary drains; including fittings, accessories and bedding.

C. Structures for access to underground piping.

D. Connection of building sanitary drainage system to municipal sewers.

### 1.2 REFERENCES

A. Plumbing and Drainage Institute (PDI).

### 1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

### 1.4 SUBMITTALS

A. Shop Drawings: The Contractor shall submit a Shop Drawing portfolio showing all piping, fittings, manholes, covers, etc., provided under this section prior to construction.

B. Project Record Drawings: The Contractor is to retain the services of a Registered Land Surveyor to prepare a utility verification survey.

1. After the date of Substantial Completion and prior to the release of retainage, the Record Drawings shall be transmitted to the Architect.

### 1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

1. Local Codes and Ordinances.

2. Local Authority having Jurisdiction.

## 1.6 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction. All Work required to be constructed by regulatory authorities in a manner differing from the Contract Documents shall be considered part of the Base Bid Contract.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

E. Submit documents under the provisions of Division One Specifications.

F. Record location of pipe sizes, materials and runs, connections, manholes, cleanouts and invert elevations.

G. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

H. The Contractor is to employ the services of a Registered Land Surveyor to perform the specified layout work.

## 1.7 FIELD MEASUREMENTS

A. Verify actual locations of sanitary sewage systems with other construction to which sewage systems must fit by accurate field measurements before installation. Coordinate installation schedule with construction progress to avoid delay of the Work. No additional compensation will be given for problems resulting from the Contractors failure to verify and/or coordinate sanitary sewer work.

## 1.8 COORDINATION

A. Prior to construction and start of building plumbing, the Contractor shall coordinate all work with the Building Mechanical Contractor and any public agency where connections are to be made. The Contractor is to verify all pipe sizes, material and invert elevations at connections. No additional compensation will be allowed for work not verified or not coordinated.

## 1.9 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. Protection of Persons: Install barricade, as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may currently exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements.

## 1.10 WARRANTY

A. Provide written warranty under the provisions of Division One Specifications.

B. Warranty: State that all materials and workmanship provided are guaranteed against defects after completion and final acceptance of the Work. Defects due to faulty materials or workmanship developed during the guarantee period shall be satisfactorily repaired or replaced by the Contractor at their expense.

# PART 2 PRODUCTS

## 2.1 GENERAL

A. Use new materials that conform to the requirements for class, kind, size and materials as specified.

## PART 3 EXECUTION

### 3.1 MATERIAL HANDLING

A. Proper and adequate implements, tools and facilities satisfactory to the Architect shall be provided and used by the Contractor for the safe and convenient prosecution of the Work. During the process of unloading, the Contractor shall inspect all pipe and accessories for damage. The Contractor shall notify the Architect of all material found to have cracks, flaws or other defects. The Engineer shall inspect the damaged materials and have the right to reject any materials found to be unsatisfactory. The Contractor shall promptly remove all rejected material from the site. All materials shall be handled carefully to prevent damage to protective coatings, linings and joint fillings; preclude contamination of interior areas; and avoid jolting contact, dropping or dumping.

B. While suspended and before being lowered into laying position, each pipe section and appurtenant unit shall be inspected by the Contractor to detect damage or unsound conditions that may need corrective action or be cause for rejection. The Contractor shall inform the Architect of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection.

C. Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blisters, rough edges or projections and any imperfections so detected shall be corrected by cleaning, trimming or repair as needed.

### 3.2 PIPE ALIGNMENT AND GRADE

A. General Requirements: Lay and maintain pipe to the required lines and grades (with manholes and fittings at the required locations). Lay pipes to the depth shown on the Contract Drawings.

B. Maintain the line and grade of the pipe in the trench by laser or batter board method.

### 3.3 TRENCHING, BACKFILLING AND COMPACTING

A. Conform to the Drawings and with the provisions of Section 31 2333 - Trenching, Backfilling and Compacting for Utilities.

### 3.4 LAYING OF PIPE

A. Plug the pipe under construction at any existing manhole until the system is completed. Proceed pipe laying with the spigot end pointed in the direction of flow. The laying of pipe shall conform to the class of bedding specified. Pipe shall not be laid in water or when the trench conditions are unsuitable for work. Protect the exposed ends of all pipes with a board or approved stopper to prevent earth or substances from entering the pipe.

B. Carefully clean the interior of the sewer from dirt, cement or superfluous material of every description as the work progresses. If necessary, thoroughly flush pipe at the completion of the Work.

## 3.5 FIELD QUALITY CONTROL

A. Record Drawings: The Contractor is to retain the services of a Registered Land Surveyor to prepare a utility verification survey. The Registered Land Surveyor shall check the following:

1. Invert elevations at all manholes to the bottom of the structures and pipes.

2. Pipe diameter within structures.

3. Structure inside diameter.

4. Horizontal verification of structures and pipes.

5. The surveyor shall supply a reproducible record drawing and an AutoCAD compatible record drawing.

B. If tests and inspections indicate that the Work does not meet the specified requirements, remove Work, replace and retest at no cost to the Owner.

## 3.6 TESTING/INSPECTION

A. All testing shall be witnessed by the local Plumbing Inspector and the Owner's Representative or the Architect. The Contractor shall provide forty-eight (48) hours notice to the Owner's Representative or the Architect prior to conducting tests.

B. Visual Inspection:

1. Sanitary sewer pipes shall be straight and uniform in alignment and grade. Pipe and manholes shall be free of dirt, mortar and other debris.

C. Deflection Test:

1. Deflection tests shall be performed on all plastic gravity sewer pipes. The test shall be conducted after the sewer trench has been backfilled to the desired finished grade and has been in place for 30 days.

2. The deflection test shall be performed by pulling a rigid ball or pointed mandrel through the pipe without the aid of mechanical pulling devices. The ball or mandrel shall have a minimum diameter equal to 95 percent of the actual inside diameter of the pipe. The maximum allowable deflection shall not exceed 5 percent of the pipes internal diameter. The time of the test, methods of testing and the equipment to be used for the test shall be subject to the approval of the Architect.

3. The Contractor at their expense shall perform all testing without any direct compensation being made therefore and they shall furnish all necessary equipment and materials required.

4. Test Failure and Remedy: Any test section that fails shall be replaced, with all repair work subject to the approval of the Architect. The replaced section shall be re-tested for leakage and deflection in conformance with the Specifications contained herein.

5. All repairs, replacement and re-testing shall be at the Contractor's expense.

D. Sanitary Sewer Leakage Testing

1. All sanitary sewer lines, including service connections, shall be substantially watertight and shall be tested for excessive leakage upon completion and before connections are made to the service by others.

2. The Contractor shall perform all testing without any direct compensation being made therefore and the Contractor shall furnish all necessary equipment and materials, including plugs and standpipes as required.

E. Testing Failure and Remedy:

1. In the event of test failure on any test section, testing shall be continued until all leakage has been detected and corrected to meet the requirements. All repair work shall be subject to the approval of the Architect. Introduction of sealant substances by means of the test water will not be permitted.

2. Unsatisfactory repairs or test results may result in an order to remove and replace pipe as the Architect considers necessary for test conformance. All repair and replacement work shall be at the Contractor's expense.

F. Televising:

1. Sewer line televising may be required by the Architect, at the cost of the Contractor, if visual inspection, leakage testing or deflection testing indicate the sewer has not been constructed in accordance with these Specifications and the requirements of the Plans, Specifications and Special Provisions.

## 3.7 PROTECTION

A. Protect finished installation under the provisions of Division One Specifications.

B. Protect pipe and aggregate cover from damage or displacement until the backfilling operation is in progress.

END OF SECTION

# SECTION 33 4000 - STORM DRAINAGE

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Site storm drainage construction to buildings and municipal storm drainage: including all pipes, fittings, attachments and connections needed for a complete and proper installation.

C. Protection of completed system against infiltration during subsequent construction activities.

### 1.2 REFERENCES

### 1.3 QUALITY ASSURANCE

A. All Work of this section occurring on public property shall be constructed in accordance with the laws, ordinances, rules, regulations, and orders of any public authority having jurisdiction.

B. Conform to all applicable code for materials and installation of the Work of this Section.

C. Verify that survey bench mark and intended elevations for the Work are as indicated.

D. The Contractor is responsible for coordinating construction schedule and required testing with testing agency prior to start of construction.

E. Record location of pipe sizes, materials and runs, connections, manholes, cleanouts and invert elevations.

F. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

G. The Contractor is to employ the services of a Registered Land Surveyor to perform the specified layout work.

### 1.4 FIELD MEASUREMENTS

A. Verify actual locations of storm sewage systems with other construction in which sewage systems must fit by accurate field measurements before installation. Coordinate installation schedule with construction progress to avoid delay of the Work. No additional compensation will be given for problems resulting from Contractor's failure to verify and/or coordinate storm sewer work.

## 1.5 SUBMITTALS

A. Submit under the provisions of Division One Specifications.

B. Shop Drawings: The Contractor shall submit a Shop Drawing portfolio showing all piping, fittings, manholes, covers, etc. provided under this Section prior to construction.

C. Record Drawings: The Contractor is to retain the services of a Registered Land Surveyor to prepare a utility verification survey. Refer to Part Field Quality Control of this specification section.

1. After the date of Substantial Completion and prior to the release of retainage, the Record Drawings shall be transmitted to the Architect.

D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

## 1.6 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

## 1.7 PROJECT CONDITIONS

A. The Contractor shall visit the site and review all Drawings, Specifications, and Geotechnical report prior to bidding. No additional compensation will be allowed for items that could have been clarified prior to bidding.

B. Protection of Persons: The Owner's activities will continue about the site during construction. Install barricade fencing (snow fence), as necessary, to provide a safe environment between construction work and pedestrian circulation.

C. Protection of Existing Property to Remain: Protect existing bench marks, survey control points, existing structures, fences, sidewalks, paving, curbs, utilities, and other miscellaneous items that are in areas where Work will be performed and which are to remain. Repair or replace existing property that is to remain that is damaged by the Work of this Contract, to the Architect/Engineer's satisfaction and at no cost to the Owner.

D. Existing Utilities:

1. Existing utilities may exist within the constructing areas, including waterworks, storm drainage, sanitary sewers, gas mains, and other utilities.

2. Locate and mark these and other possible unknown utility lines.

3. The Contractor will be held responsible for the workmanlike repair of any damage done to any of these existing utilities in the execution of their Work under this section.

E. Traffic Control:

1. Maintain vehicular and pedestrian traffic as required for construction activities.

2. Provide flag men, barricades, warning signs, and warning lights for the movement of traffic and safety and to cause the least interruption of the Work.

3. When working in public right-of-way, the Contractor is responsible for all traffic control and permit requirements.

## 1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect products to the site under the provisions of Division One Specifications.

## 1.9 WARRANTY

A. Provide written warranty under the provisions of Division One Specifications.

B. Warranty: State that all materials and workmanship provided are guaranteed against defects after completion and final acceptance of the Work. Defects due to faulty materials or workmanship developed during the guarantee period shall be satisfactorily repaired or replaced at no additional expense to the Owner.

# PART 2 PRODUCTS

## 2.1 PIPE AND MATERIAL

A. General:

1. Materials required for this Work shall be new materials conforming to the requirements of the referenced Specification for the class, kind, type, size, grade and other details indicated on the Drawings.

2. Wherever connection of dissimilar materials or design is required, the method of joining and any special fittings employed shall be subject to approval by the Architect.

# PART 3 EXECUTION

## 3.1 EXAMINATION

A. Examine the areas and conditions under which the Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

## 3.2 LAYING OUT WORK

A. Provide all materials, labor, instruments, etc. required to lay out the Work.

B. The Contractor is to employ the services of a Registered Land Surveyor to perform specified layout work.

C. Exercise proper precaution to verify figures on the drawings prior to laying out the Work. The Contractor will be held responsible for any errors therein that otherwise might have been avoided.

D. Promptly inform the Architect of errors or discrepancies found, in order that proper corrections may be made.

## 3.3 INSTALLATION OF STORM DRAINAGE

A. Trenching, Backfilling and Compacting.

1. Trenching and backfilling shall be constructed in accordance with Section 31 2333 - Trench Excavation and Backfill for Utilities.

B. Installing Piping and Appurtenances:

1. Provide and use the proper implements, tools and facilities for the safe and convenient prosecution of the Work.

2. Unload and distribute materials at the site carefully to prevent materials from being damaged, minimize handling and not hamper construction activities. In no case shall materials be thrown or dumped from the truck.

3. Lower pipe into trench carefully to prevent damage to pipe and protective coatings and linings. Under no circumstances shall pipe be dumped into the trench.

C. Immediately before placement, the joint surfaces of each pipe section and fitting shall be inspected for the presence of foreign matter, coating blister, rough edges and projections, and any other imperfections so detected shall be corrected by cleaning, trimming or repair as required.

D. Pipe shall be laid using laser equipment or grade boards. Grade boards shall be furnished and set by the Contractor according to the established grade stakes. No pipe shall be laid unless there is a minimum of four (4) grade boards set to check the proper grade and alignment ahead. Provide and use a suitable grade rod to ensure the proper grade of the pipe. Grade boards shall be no more than twenty-five (25') feet apart.

E. At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate. Bell and spigot pipe shall be laid with the bell ends facing upgrade and the laying shall start at the downgrade end and proceed upgrade.

F. As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced hole and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted around the pipe. The joint areas shall remain exposed and precautions shall be taken to prevent soil from entering the joint space.

G. When existing utility structures or branch connections leading to main sewers or to main drains present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed.

H. When water main, water services and sewer services, whether lowered or existing, are in danger of freezing due to proximity of storm sewers, catch basin leads or storm sewer structures, the Architect may direct the placement of insulation between the storm sewer and the water main or service pipe at no additional cost to the Owner or the Owner's representative.

I. Openings along the line of the storm sewer shall be securely closed, and at the suspension of the Work at any time, suitable stops shall be placed to prevent earth or any substance from entering the storm sewer. If water is present in the trench, the seals shall remain in place until the trench is completely dry.

## 3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under the provisions of Division One Specifications.

B. General:

1. All pipes shall be visually inspected.

2. All visible leaks shall be repaired.

3. Broken or cracked pipe, mislaid pipe and other defects shall be corrected.

4. All repairs, relaying of sewers, etc. required to bring the sewers to specified status shall be made at no additional cost to the Owner or the Owner's representative.

C. Inspection:

1. Request inspection prior to and immediately after placing aggregate cover over pipe.

2. Compaction testing will be performed in accordance with ASTM D698.

3. Clean and prepare for inspection each block or section of sewer upon completion, or at such other time as the Architect may direct.

D. Record Drawings: The Contractor is to retain the services of a Registered Land Surveyor to prepare a utility verification survey. The surveyor shall check the following:

1. Invert elevations at all manholes to the bottom of the structures and pipes.

2. Pipe diameter within structures.

3. Structure inside diameter.

4. Horizontal verification of structures and pipes.

5. The surveyor shall supply a reproducible record drawing and an AutoCAD compatible record drawing.

E. If tests indicate that Work does not meet specified requirements, remove Work, replace and retest at no additional cost to the Owner or the Owner's representative.

## 3.5 ADJUSTING AND CLEANING

A. Correcting Deficiencies: Correct imperfections and irregularities in Work at no expense to the Owner.

B. Cleaning Drains: Drains shall be free of silt, debris and other obstructions at the time of final acceptance.

C. Cleaning Site: Remove excess earth, excess construction materials, construction equipment and construction debris, which is related to this Work, from the site at the completion of the work.

D. The Contractor shall clean all sumps after final surfaces are established and prior to project closeout.

## 3.6 PROTECTION

A. Protection of finished work under provisions of Division One Specifications.

B. General Requirements: Protect storm drainage system from damage and construction operations until date of Substantial Completion.

END OF SECTION

**Structural Testing and Special Inspection Program Summary Schedule**

Project Name: Holiday Inn Express Project No.: 14-081
Location: TBD Permit No.: _____ (1)

| Technical (2) | | Description (3) | Type of Inspector (4) | Report Frequency (5) | Assigned Firm (6) |
|---|---|---|---|---|---|
| Section | Article | | | | |
| 1704.2.1 | Inspection of Fabricators | The special inspector shall verify that the fabricator maintains detailed fabrication and quality control procedures that provide a basis for the inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards. The special inspector shall review the procedures for completeness and adequacy relative to the code requirements for the fabricator's scope of work. | Technical | Periodic | TA |
| 1704.3.1.a | Steel Construction | Material verification of high strength bolts, nuts and washers: Identification markings to conform to ASTM standards specified in the approved construction documents. | Technical | Periodic | TA |
| 1704.3.1.b | Steel Construction | Material verification of high strength bolts, nuts and washers:<br>Manufacturer's certificate of compliance required. | Technical | Periodic | TA |
| 1704.3.2.a | Steel Construction | Inspection of high strength bolting:<br>Bearing-type connections | Technical | Periodic | TA |
| 1704.3.5.a.4 | Steel Construction | Inspection of welding:<br>Structural Steel; single pass fillet welds <5/16" | Technical | Periodic | TA |
| 1704.3.5.a.5 | Steel Construction | Inspection of welding:<br>Structural Steel; floor and deck welds | Technical | Periodic | TA |
| 1704.3.6 | Steel Construction | Inspection of steel frame joint details for compliance with approved construction documents:<br>a. Details such as bracing and stiffening<br>b. Member location<br>c. Application of joint details at each connection | Technical | Periodic | TA |
| 1704.4.1 | Concrete Construction | Inspection of reinforcing steel, including pre-stressing tendons, and placement | Technical | Periodic | TA |
| 1704.4.4 | Concrete Construction | Verifying use of required design mix | Technical | Periodic | TA |
| 1704.4.5 | Concrete Construction | At the time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete | Technical | Continuous | TA |
| 1704.4.6 | Concrete Construction | Inspection of concrete and shot-crete placement for proper application techniques. | Technical | Periodic | TA |
| 1704.4.7 | Concrete Construction | Inspection for maintenance of specified curing temperature and techniques. | Technical | Periodic | TA |

Notes: This schedule shall be filled out and included in the Structural Testing and Special Inspection Program.

1) Permit No. to be provided by the Building Official.
2) Referenced to the specific technical scope section in the program.
3) Use descriptions per State Adopted IBC Chapter 17, Section 1704, as amended by Applicable State Building Code.
4) Special Inspector – Technical, Special Inspector – Structural, Testing Agency.
5) Weekly, monthly, per test/inspection, per floor, etc.
6) Firm contracted to perform services.

Structural Testing and Special Inspection Schedule
Holiday Inn Express
Feb 2015

ACKNOWLEDGMENTS
(Each appropriate representative shall sign below)

| | | | | | |
|---|---|---|---|---|---|
| Owner: | | Firm: | InterContinental Hotel Group | Date: | |
| Contractor: | | Firm: | TBD | Date: | |
| Architect: | | Firm: | Mishra Architecture PLLC | Date: | |
| SER: | | Firm: | WGPM, Inc. | Date: | |
| SI-S: | | Firm: | TBD | Date: | |
| TA: | | Firm: | TBD | Date: | |
| SI-T: | | Firm: | TBD | Date: | |
| F: | | Firm: | TBD | Date: | |

If requested by engineer/architect of record or building official, the individual names of all prospective special inspectors and the work they intend to observe shall be identified as an attachment.

Legend:

| | | | |
|---|---|---|---|
| SER: | Structural Engineer of Record | SI-T: | Special Inspector – Technical |
| TA: | Testing Agency | SI-S: | Special Inspector – Structural |
| F: | Fabricator | | |

Accepted for the Building Department By_____Date_____

# LADNER

JACKSON - HATTIESBURG - GULFPORT
(601) 362-5421 (601) 544-5782 (228) 604-2527

## SUBSURFACE INVESTIGATION

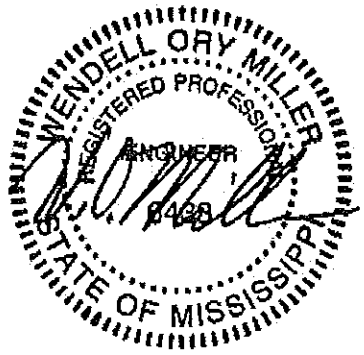
## FOR

## HOLIDAY INN EXPRESS
## SOUTHCREST PARKWAY
## SOUTHAVEN, MISSISSIPPI

## NOVEMBER 2012
## REVISED

## BY

GEOTECHNICAL ASSOCIATES NETWORK, LLC
110 BEECHTREE ROAD
VICKSBURG, MISSISSIPPI 39183-7464



# SUBSURFACE INVESTIGATION FOR
# HOLIDAY INN EXPRESS
# SOUTHCREST PARKWAY
# SOUTHAVEN, MISSISSIPPI

## PURPOSE

The purposes of this subsurface investigation are as follows:

a. To determine the general characteristics of the subsurface soils within the area of the proposed construction;

b. To determine by field and laboratory testing, the physical characteristics of the foundation soils and the soil samples collected; and

c. To make recommendations for foundation construction at this particular location.

## FIELD INVESTIGATION

Nine subsurface borings were made for the proposed Holiday Inn Express in Southaven, Mississippi. The borings were advanced with a truck mounted, powered continuous flight auger. Auger cuttings of the soil medium were collected at changes in strata and at intervals not exceeding five feet in depth. All samples were stored in sealed containers for later classification and testing. In addition, standard penetration resistance values (see ASTM D-1586-84) were determined and recorded on the boring logs for the various materials encountered. The Standard Penetration Test gives an indication of the in-place shear strength of cohesive soils and the relative density of cohesionless soils by recording the number of blows required, by a 140-pound hammer falling 30 inches, to drive a 2-inch O.D. splitspoon sampler one foot. Any static water levels noted in the borings while drilling or after completion of drilling and sampling operations at the site were measured and recorded on the boring logs.

## LABORATORY INVESTIGATION

Laboratory testing of selected soil samples included visual classification, Atterberg limits on cohesive soils with determination of the plasticity index (PI), grain size analyses, and in situ moisture contents. Atterberg limits (ASTM D-4318-93) were run on the clayey soils in an effort to estimate the susceptibility of these soils to shrink and swell with changes in moisture content. Liquid and plastic limits were run on samples selected from some of the various materials encountered. The liquid limit (LL) is the moisture content at which a soil changes from a plastic state to a viscous liquid state. The plastic limit is the moisture content at which a soil changes from a solid state to a plastic state. The plasticity index is the numerical difference between the liquid limit and the plastic limit and is indicative of the relative activity or sensitivity of a cohesive soil.

Grain size analyses (ASTM D-422-63) were conducted on representative samples of the various soils encountered to determine the particle size distribution of materials comprising the strata. Results of these tests were utilized in classifying the soils by the Unified Soil Classification System and in estimating the California Bearing Ratio (CBR) of the soils. Classifications for each of the soil samples are shown on the boring logs and test results attached to this report.

To aid in the general interpretation of the soil conditions at the site, in situ moisture contents were determined for samples selected from the various soils encountered. This determination was made possible by placing extracted samples in sealed containers immediately upon removal from each interval. The results of these and other tests are recorded on the attached boring logs.

## SUBSURFACE CONDITIONS

The proposed construction for Holiday Inn Express is located on Southcrest Parkway in Section 25, Township 1 South, Range 8 West, Southaven, Desoto County, Mississippi in the Loess Bluffs physiographic unit of Mississippi. This unit lies in the Gulf Coastal Plain physiographic province of North America. Structurally, the area is on the east flank of the Mississippi Embayment, north of the Mississippi-Arkansas trough, and northwest of the Senatobia Ridge. Stratigraphically, the soils

in this area are mainly derived from the Pleistocene Loess deposits and the Eocene Kosciusko Formation. The loess is a wind-deposited material that tends to have uniform engineering properties. The Kosciusko Formation is a non-marine deltaic unit.

Nine borings were advanced at the site: four to depths of 15 feet; one to a depth of 40 feet; and, four to depths of 10 feet. The materials noted in the borings were predominantly lean clay (CL) with clayey sand (SC) noted below 30 feet in Boring No. B-5. Please see the Soils Data Table below. The soil colors were mainly brown, gray, and tan with some red. The Standard Penetration Test (SPT) blow-count data suggested the clays were medium to hard in consistency, and the relative density of the clayey sands was medium to dense.

**Soils Data Table**
Holiday Inn Express
Southaven, MS

| Boring | CL | CL w/tr grav or w/grav | CL w/sd | SC | Total Depth |
|---|---|---|---|---|---|
| B-1 | 0' - 13 1/2' | 13 1/2' - 15' | | | 15' |
| B-2 | 0' - 15' | | | | 15' |
| B-3 | 2 1/2' - 5' | 0' - 2 1/2'; 5' - 15' | | | 15' |
| B-4 | | 0' - 15' | | | 15' |
| B-5 | 0' - 13 1/2' | 13 1/2' - 30' | | 30' - 40' | 40' |
| P-1 | 0' - 10' | | | | 10' |
| P-2 | 0' - 2 1/2' | 2 1/2' - 10' | | | 10' |
| P-3 | 0' - 10' | | | | 10' |
| P-4 | 0' - 2 1/2' | | 2 1/2' - 10' | | 10' |

Depths are in feet (') below the surface.

Most of the material encountered in the borings was lean clay (CL) to lean clay with gravel (CL) as can be seen in the Soils Data Table above. These clays were brown, tan, and gray; tan; tan, gray, and brown; red, brown, and tan; brown; brown and tan; tan and gray; tan and brown; and tan and red in color. Consistencies were medium to hard as inferred from SPT blow counts that ranged from 5 blows to 36 blows (average 16 blows). Percent passing through the #200 grain-size sieve varied from

60.4 percent to 98.6 percent and averaged 92.1 percent. These are low to medium plasticity clays with plasticity indices ranging from 10 percent to 20 percent (average 13.9 percent) and liquid limits ranging from 31 percent to 42 percent (average 35 percent). Small to moderate changes in volume could be noted with changes in moisture content. Field moisture contents ranged from 8.3 percent to 23.0 percent and averaged 16.5 percent. These lean clays can lose strength with increases in moisture content.

One stratum of red to tan and gray clayey sand with gravel (SC) was noted in Boring No. B-5 (see Soils Data Table above). Field moisture contents were 21.1 percent in each sample; 20 percent and 35 percent passed the #200 grain-size sieve. The clay content lent low plasticity to the sand: plasticity indices were 13 percent and 15 percent and liquid limits were 29 percent and 43 percent. No significant changes in volume are anticipated with changes in moisture content. Relative densities of the sand were medium to dense as inferred from SPT blow counts of 20 blows and 35 blows.

No static water levels were noted during or after completion of drilling and sampling operations as noted on the Soils Data Table above. The actual water table at the site can only be determined with long-term observations. We note that groundwater conditions in this area do fluctuate during the year with variations in rainfall and other environmental factors. Therefore, the groundwater levels and soil moisture contents will vary throughout the year and will probably be different if tested at a different time.

## RECOMMENDATIONS FOR SITE PREPARATION AND FOUNDATIONS

We understand that this project will consist of adding a new Holiday Inn Express in Southaven, Mississippi. The following conclusions and recommendations are based on our understanding of the proposed construction, information gathered during the exploration, accepted geotechnical engineering principles and practices, and our experience with similar sites and subsurface conditions. This report has been prepared for the exclusive use of Roy Patel, Brandon, Mississippi in the planning and design of the building. We request that we be informed of any significant changes to the proposed construction so we might review our recommendations in light of the new information. We should also be given an opportunity to review the final foundation and grading plans, as well as applicable portions of the project specifications, prior to construction.

Final plans and specifications were not available at the time of this geotechnical report, but the footprint of the building will be on a construction area that is essentially flat. Based upon our interpretation of the soil conditions at the site, it is our opinion that the proposed construction could be supported using a pile foundation. Further details of our recommendations are discussed below.

## SITE PREPARATION

As noted above, the materials noted in the borings were predominantly lean clay (CL) with some traces of gravel and with clayey sand (SC) noted below 30 feet. The Standard Penetration Test (SPT) blow-count data suggested the clays were medium to hard in consistency, and the relative density of the clayey sands was medium to dense.

The soil strengths at this site are variable with low to medium strength down to approximately 3 feet. The next layer was not continuous across the building but it is a high strength layer estimated to be 3 to 5 feet thick. The third layer is estimated to be from a depth of 8 feet to 23 feet and is a medium strength material. The final layer from 23 feet to the depth of the boring at 40 feet is a high strength material.

Any type of slab foundation for a 5-story hotel, built on the given site, would require one of the following options, Option A - excavating 15 feet of material and replacing it with compacted select fill. Option B - a drilled pile foundation would have to be founded on the hard lean clay at a minimum of 25 feet deep. Option C - A Geopier foundation could be used but this is a proprietary design and is required to be designed by the company.

Following excavation we recommend that the subgrade in all fill areas be evaluated by a geotechnical engineer or his representative prior to fill placement. The engineer may recommend proof-rolling the areas as a means of evaluating the suitability of the subgrade for fill. Proof-rolling consists of systematically patrolling the area preferably in perpendicular directions, utilizing a heavily loaded dump truck (minimum 20 tons) or other suitable vehicle approved by the engineer. Any areas which pump or rut excessively and which cannot be densified by continued rolling should be undercut to suitable material and properly backfilled. If the construction footprint is too small for proof-rolling, numerous density tests or hand held cone

penetration tests should be conducted to determine soft areas. The measured penetration resistance at each location can be subsequently converted to an in situ bearing capacity for the foundation.

Select structural-fill material should be placed in maximum loose lifts of 8 inches and should be compacted to 98 percent standard Proctor density (ASTM D-698-91) within 2 percentage points of optimum moisture content. Sufficient field density tests should be conducted to insure compaction requirements are met during construction. As a rule of thumb, we recommend that two density tests per lift be performed for each 2000 square feet of surface area. In addition, monitoring of fill construction and compaction will result in minimizing future settlement of the fill and the structure. Therefore, we believe that it is important that a qualified geotechnical engineer or certified technician monitor earthwork operations and that this work not be controlled by the earthwork contractor.

The select, structural-fill material should consist of a material having a liquid limit of less than 40 percent and a plasticity index between 8 percent and 20 percent. The excavated materials that include topsoil should not serve as select fill and should be disposed of outside the foundation area. Excavated material that meets the specifications described here could be used as select fill.

## FOUNDATION STRENGTHS

The foundation system should bear in the compacted select fill at a minimum depth 24 inches below the finished grade elevation. Minimum depths needed to offset wind forces should be verified by your structural engineer. All foundation members should be reinforced both top and bottom, sufficient to resist differential movement, and the completed foundation system should provide for uniform distribution of applied loads to the bearing soils. The maximum soil pressure under the foundation members should not exceed 2.7 kips per square foot for continuous foundation units or 3.0 kips per square foot for individual spread footings. Foundations sized in accordance with recognized criteria for the above stated allowable soil bearing pressure should provide a factor of safety of 2.0 - 3.0 against ultimate failure of the soil medium with total estimated settlements of 1 inch, more or less.

The building could be founded on end bearing piles at a depth of 25 feet on the very stiff to hard lean clay (CL). The maximum soil pressure under the foundation members should not exceed 12 kips per square foot for individual piles. Foundations sized in accordance with recognized criteria for the above stated allowable soil bearing pressure should provide a factor of safety of 2.0 against ultimate failure of the soil medium.

## SITE MAINTENANCE

Note that the soils at this site contain lean clays (CL) that can lose strength with increases in moisture content. It is important to properly control the moisture content of these soils during construction. Recent inspections of several buildings that have had differential movement have noted water exiting from gutters beside the foundations and inadequate grades for the swales that should remove surface water. The final site-grading plan should provide for quick runoff of surface waters away from the building foundations in all directions. Any beds for flowers and shrubs should not be boxed in and should be sloped down away from the building foundation. Sprinkler systems located close to the building foundation should be controlled by nearby soil moisture content and not specific time schedules. In addition, any foundation soils in exposed excavations that become wet or soft should be removed and replaced prior to footing installation. The landscape plans should insure that large water consuming trees and shrubs are not located within 50 feet of the perimeter of the foundation members. Where any large trees or stumps are removed or where any plumbing or electrical trenches are cut under the foundation, select fill material should be used and compacted.

All foundation recommendations made in this report are contingent upon proper execution of the earthwork requirements noted herein. We believe that it is very important that a qualified geotechnical engineer, familiar with working with such soils, be present during foundation construction.

## RECOMMENDATIONS FOR PARKING AREAS AND ACCESS DRIVES

As noted above, the near-surface material occurring under the paving construction area consisted of lean clay (CL) materials with small traces of gravel and sand. Consistency of these clay materials, as inferred from Standard Penetration Test (SPT) data, was stiff to hard.

The foundation soil should be excavated a minimum of 1 foot, independent of the amount of select fill to be used, to remove any topsoil, debris, and organics. The soils at this site are variable in both strength and composition. Every effort should be made to insure that the exposed soils do not "dry out" during construction. Any soft or wet areas encountered during construction which cannot be stabilized should be undercut and filled with compacted select material.

We recommend proof-rolling the area as a means of evaluating the suitability of the subgrade for fill or pavement support. Proof-rolling is defined above. We recommend that, after proof-rolling, the subgrade soils for any cut sections should be compacted to 98 percent standard Proctor density (ASTM D-698-91) within 2 percentage points of optimum moisture content to a depth of 8 inches.

Compacted fill should then be placed to bring the subgrade up to elevation where required. Prior to placing the select fill in any area, we recommend that the subgrade be evaluated by a geotechnical engineer or his representative to determine the suitability of the subgrade.

Select-fill material should consist of a soil having a liquid limit of not more than 40 percent and a plasticity index between 8 percent and 22 percent. This soil should be placed in maximum loose lifts of 8 inches and also compacted to a minimum of 98 percent standard Proctor density. Compaction for the entire site could be attained using a rubber tired or sheeps foot roller. After preparation of the subgrade, the remaining pavement structure can then be placed according to the recommendations provided below.

Based on the type of soils encountered, we anticipate that a CBR value greater than 3 will be representative of the strength of the prepared subgrade soils and compacted fill placed at this site, assuming proper control of the soil moisture content. It is our assumption that the parking lot and access drive will be used by the guests, employees, and a minimum of two-axle trucks for any deliveries; this precludes street traffic. Based on that assumption and the soil properties, we have selected a Structural Number (SN) of 2.3 for the parking lot and 2.9 for the access drive design and the dumpster pad (based on AASHTO Guide for Design of Pavement Structures, Chapter 4, Low-Volume Road Design, 1986). One of the following pavement alternatives should be used, assuming proper compaction of the subgrade soils:

## LIGHT PARKING

Alternative #1

a) Base Course - Five (5) inches of hot mixed Bituminous Base course (BB-1, Type 6) conforming to Mississippi State Highway Department (MSHD) Specifications.

b) Surface Course - One and one half (1 ½) inches of hot mixed bituminous Surface Course (SC-1, Type 8) conforming to MSHD Specifications.

Alternative # 2

a) Granular Subbase - Six (6) inches of crushed limestone, No. 610 conforming to MSHD Specifications.

b) Base Course - Four (4) inches of hot mixed Bituminous Base, (BB-1, Type 6) conforming to MSHD Specifications.

c) Surface Course - One and one-half (1 ½) inches of hot mixed bituminous Surface Course, (SC-1, Type 8) conforming to MSHD Specifications.

Alternative #3

Surface Course - Five (5) inches of Portland Cement Concrete.

## ACCESS ROADS

Alternative #1

a) Base Course - Six and one-half (6 ½) inches of hot mixed Bituminous Base, (BB-1, Type 6) conforming to (MSHD) Specifications.

b) Surface Course - One and one-half (1 ½) inches of hot mixed bituminous Surface Course, (SC-1, Type 8) conforming to MSHD Specifications.

Alternative # 2

Surface - Six (6) inches of Portland Cement Concrete.

## DUMPSTER PAD

Surface - Six (6) inches of Portland Cement Concrete. The dumpster pad should be the total length of dumpster and the garbage truck.

The concrete pavement recommendations are for non-reinforced Portland Cement concrete pavement placed on a eight-inch-thick 610 limestone base course placed on the compacted subgrade. The base course should be compacted to a minimum of 98 percent standard Proctor density immediately prior to concrete placement. The concrete should have a minimum 28-day flexural strength of 650 psi and a compressive strength of 4000 psi. Joint spacing, joint configuration, mix design, mix placement, and curing should conform to the recommendations of the American Concrete Institute (ACI) and the Portland Cement Association (PCA).

Applicable Mississippi State Highway Department specifications and structural number coefficients utilized in the pavement recommendations are provided as follows:

a) Bituminous Surface Course - Structural Coefficient = 0.44- hot mixed bituminous Surface Course (SC-1, Type 8) - Mississippi Standard Specifications for Road and Bridge Construction (1990 edition), Section 703, Pages 703-14&15 or from the AASHTO Interim Guide for Design of Pavement Structures.

b) Bituminous Base Course - Structural Coefficient = 0.34 - hot mixed Bituminous Base Course (BB-1, Type 6) - Mississippi Standard Specifications for Road and Bridge Construction (1990 edition), Section 703, Pages 703-14&15 or from the AASHTO Guide.

c) Granular subbase - Structural Coefficient = 0.11 - crushed limestone, No. 610, ASTM D 2940-98 Specifications or from the AASHTO Guide.

All pavement design recommendations made in this report are contingent upon proper execution of the subgrade requirements noted herein. We believe that it is very important that a qualified geotechnical engineer, familiar with working with such soils, be present after excavation and during proof-rolling, fill, and compaction. In addition, sufficient field-density tests should be taken to insure that the compaction criteria are satisfied, and to reduce the possibility of settlement at this location. It is important that a good drainage system be

established to quickly remove surface water, thus leaving no standing water.

## REPORT LIMITATIONS

The recommendations made in this report are based on the assumption that the borings are representative of the subsurface conditions throughout the site. Therefore, we cannot warrant that our boring logs represent subsurface conditions at other locations or times. If during construction, any unusual or significantly different conditions are encountered, we should be advised in order to review the changed conditions, and subsequently reconsider any of the above recommendations.

Further, we are available to review those portions of the plans and specifications relating to earthwork and foundations for this particular project and request that we be retained to do so in order to determine whether the plans and specifications are consistent with the recommendations contained within this report. In addition, we are available to observe foundation construction procedures, including interpretation of the use of on-site materials and compaction of the structural fill, quality control of concrete placement, and other field observations and quality-control measures as required.

# LADNER

JACKSON - HATTIESBURG - GULFPORT
(601) 362-5421 (601) 544-5782 (228) 604-2527

## SUBSURFACE INVESTIGATION

## FOR

## ADDEMDUM 1
## HOLIDAY INN EXPRESS
## SOUTHCREST PARKWAY
## SOUTHAVEN, MISSISSIPPI

## NOVEMBER 2012

## BY

GEOTECHNICAL ASSOCIATES NETWORK, LLC
110 BEECHTREE ROAD
VICKSBURG, MISSISSIPPI 39183-7464

SUBSURFACE INVESTIGATION FOR
ADDENDUM 1
HOLIDAY INN EXPRESS
SOUTHCREST PARKWAY
SOUTHAVEN, MISSISSIPPI

**Addendum 1**

E-mail from: Ashish Mishra dated April 16, 2013 2:35 pm
The attached soil report had limited information. (1) It did not address and allowable soil bearing pressure for the stone aggregate pier (geopier) foundation system. We are accustomed to see allowable soil bearing pressure go from 2,000psf to 6,000psf-8,000psf with a stone aggregate pier system. (2) The slab on grade support was not addressed in the soil report either, I will assume that the slab on grade will be a non-structural slab supported by compacted soil. (3)Finally a soil site class for seismic activity was not addressed. I will assume a soil site class D, however, I do not know if that is an appropriate assumption for that area of the country. Thanks.

(1) It did not address and allowable soil bearing pressure for the stone aggregate pier (geopier) foundation system. We are accustomed to see allowable soil bearing pressure go from 2,000psf to 6,000psf-8,000psf with a stone aggregate pier system. Ansr: A Geopier foundation could be used but this is a proprietary design and is required to be designed by the company. (As noted in the report). Also in general the Geopier is founded at approximately 10 to 15 feet deep but the company will decide where the pier will be founded. The allowable soil bearing at this depth is 2.25 ksf. A company that installs geopiers is attached at the end of this Addendum.

(2)The slab on grade support was not addressed in the soil report either, I will assume that the slab on grade will be a non-structural slab supported by compacted soil. Ansr: Any type of slab foundation for a 5-story hotel, built on the given site, would require excavating 15 feet of material and replacing it with compacted select fill. (As noted in the report). It is our opinion that the proposed construction could be supported by a combination of foundation units, such as grade beams and spread footings. The foundation could consist of a monolithically cast, reinforced concrete, slab on-grade with turned-down, continuous grade beams and interior stiffeners to produce a beam diaphragm system. Column loads could be supported by isolated spread footings or thickened sections.

(3)Finally a soil site class for seismic activity was not addressed. I will assume a soil site class D, however, I do not know if that is an appropriate assumption for that area of the country.

Seismic considerations are taken from the 2009 Building Code (IBC) Site Classification. We recommend in general that a site classification of E be assumed as per Table 1613.5.2. The 2006 International Building Code requires a site soil profile determination extending a depth of 100 feet for seismic site classification. There was no 100 foot boring for soil profile determination. There was one boring extended to a maximum 40 feet and this seismic site class definition considers that the soils encountered continues below the maximum depth of the subsurface exploration. Other explorations could be performed to confirm the conditions or justify a higher seismic site class.

***GEOPIER™* Foundation Company - MidSouth, LLC**
"The Alternative to Deep Foundations"

**MATT CASKEY, P.E.**
Design Associate

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# LADNER

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## SUBSURFACE INVESTIGATION

## FOR

## ADDENDUM 2
## HOLIDAY INN EXPRESS
## SOUTHCREST PARKWAY
## SOUTHHAVEN, MISSISSIPPI

## MARCH 2014

## BY

GEOTECHNICAL ASSOCIATES NETWORK, LLC
110 BEECHTREE ROAD
VICKSBURG, MISSISSIPPI 39183-7464

**SUBSURFACE INVESTIGATION FOR**
**ADDENDUM 2**
**HOLIDAY INN EXPRESS**
**SOUTHCREST PARKWAY**
**SOUTHHAVEN, MISSISSIPPI**

## PURPOSE

The purpose of this subsurface investigation is as follows:

a. To make recommendations for foundation construction at this particular location.

## SITE PREPARATION

As noted above, the materials noted in the borings were predominantly lean clay (CL) with some traces of gravel and with clayey sand (SC) noted below 30 feet. The Standard Penetration Test (SPT) blow-count data suggested the clays were medium to hard in consistency, and the relative density of the clayey sands was medium to dense.

The soil strengths at this site are variable with low to medium strength down to approximately 3 feet. The next layer was not continuous across the building but it is a high strength layer estimated to be 3 to 5 feet thick. The third layer is estimated to be from a depth of 8 feet to 23 feet and is a medium strength material. The final layer from 23 feet to the depth of the boring at 40 feet is a high strength material.

## RECOMMENDATIONS FOR ACCESS DRIVES adjoining the building

It is our understanding that there may be an "Airfield Systems" natural turf driveway (See attachment) placed near the building that could be used by emergency vehicles. As noted above, the near-surface material occurring under the paving construction area consisted of lean clay (CL) materials with small traces of gravel and sand. Consistency of these clay materials, as inferred from Standard Penetration Test (SPT) data, was stiff to hard.

The foundation soil should be excavated a minimum of 1 foot, independent of the amount of select fill to be used, to remove any topsoil, debris, and organics. The soils at this site are variable in both strength and composition. We recommend excavating a minimum total of 3 feet of the surface to ensure the subbase will have adequate bearing pressures below the French drain and the rock subbase. The excavated area should be filled with compacted select fill noted below. The prepared rock subbase over the select fill should be twelve (12) inches of crushed limestone. The French drain, shown in the system drawings, should be excavated in the compacted select fill.

Every effort should be made to insure that the exposed soils do not "dry out" during construction. Any soft or wet areas encountered during construction which cannot be stabilized should be undercut and filled with compacted select material.

We recommend proof-rolling the area as a means of evaluating the suitability of the subgrade for fill or pavement support. We recommend that, after proof-rolling, the subgrade soils for any cut sections should be compacted to 98 percent standard Proctor density (ASTM D-698-91) within 2 percentage points of optimum moisture content to a depth of 8 inches.

Compacted fill should then be placed to bring the subgrade up to elevation where required. Prior to placing the select fill in any area, we recommend that the subgrade be evaluated by a geotechnical engineer or his representative to determine the suitability of the subgrade.

Select-fill material should consist of a soil having a liquid limit of not more than 40 percent and a plasticity index between 8 percent and 22 percent. This soil should be placed in maximum loose lifts of 8 inches and also compacted to a minimum of 98 percent standard Proctor density. Compaction for the entire site could be attained using a rubber tired or sheeps foot roller. After preparation of the subgrade, the remaining pavement structure can then be placed according to the recommendations provided below.

Based on the type of soils encountered, we anticipate that a CBR value greater than 3 will be representative of the strength of the prepared subgrade soils and compacted fill placed at this site, assuming proper control of the soil moisture content. It is our assumption that the access drive could be used by emergency fire equipment; this precludes street traffic. Based

on that assumption and the soil properties, we have selected a Structural Number (SN) of 2.9 for the access drive design and the dumpster pad (based on AASHTO Guide for Design of Pavement Structures, Chapter 4, Low-Volume Road Design, 1986). The following pavement should be used, assuming proper compaction of the subgrade soils:

**ACCESS ROADS**

a) Granular Subbase - Twelve (12) inches of crushed limestone, No. 610 conforming to MSHD Specifications.

b) Base Course - Four (4) inches of hot mixed Bituminous Base, (BB-1, Type 6) conforming to MSHD Specifications.

c) Surface Course - One and one-half (1 ½) inches of hot mixed bituminous Surface Course, (SC-1, Type 8) conforming to MSHD Specifications.

Applicable Mississippi State Highway Department specifications and structural number coefficients utilized in the pavement recommendations are provided as follows:

a) Bituminous Surface Course - Structural Coefficient = 0.44- hot mixed bituminous Surface Course (SC-1, Type 8) - Mississippi Standard Specifications for Road and Bridge Construction (1990 edition), Section 703, Pages 703-14&15 or from the AASHTO Interim Guide for Design of Pavement Structures.

b) Bituminous Base Course - Structural Coefficient = 0.34 - hot mixed Bituminous Base Course (BB-1, Type 6) - Mississippi Standard Specifications for Road and Bridge Construction (1990 edition), Section 703, Pages 703-14&15 or from the AASHTO Guide.

c) Granular subbase - Structural Coefficient = 0.11 - crushed limestone, No. 610, ASTM D 2940-98 Specifications or from the AASHTO Guide.

All pavement design recommendations made in this report are contingent upon proper execution of the subgrade requirements noted herein. We believe that it is very important that a qualified geotechnical engineer, familiar with working with such soils, be present after excavation and during proof-rolling, fill, and compaction. In addition, sufficient field-density tests should be taken to insure that the compaction criteria are satisfied, and to reduce the possibility of settlement at this

location. It is important that a good drainage system be established to quickly remove surface water, thus leaving no standing water.

## REPORT LIMITATIONS

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M I S H R A
ARCHITECTURE PLLC

# SUBSTITUTION REQUEST FORM

☐ Contractor
☐ Subcontractor
☐ Supplier

Name of Business: _____
Address: _____
City, State, Zip: _____
Phone: _____; Fax: _____; Email: _____

Attn: Ashish Mishra, AIA, NCARB, LEED AP
Mishra Architecture PLLC
6800 S Creek Rd, Charlotte, NC 28277; Fax: (704) 919-5822; Email: ashish@mishraarch.com

Project: _____ Place: _____ Date: _____

Specified Item:

_____ _____
Drawing #/Specification Page Description

WHY IS SUBSTITUTION BEING SUBMITTED? (Select 1 of the following):

☐ Pre-bid Substitution (Prior Approval): Include detailed analysis comparing proposed substitution against specified product, including redlined drawing/Specification Section showing differences.
☐ Specified Product is not available.
☐ Cost savings to Owner. Indicate comparative cost analysis as attachment.
☐ Other. Explain: _____

PROPOSED SUBSTITUTION:

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

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

Attachments: _____

EFFECTS OF PROPOSED SUBSTITUTION:
Does the proposed substitution affect dimensions shown on drawings? NO ☐ YES ☐

Does the proposed substitution change drawings? NO ☐ YES ☐

If yes, provide drawing numbers: _____


6800 SOUTH CREEK ROAD • CHARLOTTE • NC 28277 • P: 704-248-6252 • F: 704-919-5822

M I S H R A
ARCHITECTURE PLLC

**The undersigned states that the following paragraphs, unless modified in attachments, are correct**:

1. The undersigned will pay for changes to the building design, including engineering design, detailing and construction costs caused by the requested substitution.
2. The proposed substitution will have no adverse effects on other trades.
3. The function, appearance, and quality of the proposed substitution are *equivalent or superior* to the specified item.
4. If major changes are proposed to Contract Documents, approvals need to be obtained from authorities having jurisdiction on the above mentioned project.

Submitted by: _____PRINT NAME:_____

Firm Name: _____ Date:_____

**FOR USE BY DESIGN CONSULTANT:**

Check and Complete:

Accepted

Accepted as Noted:

Not accepted Received too Late

By:_____ PRINT NAME:_____

Date: _____

Remarks: _____
_____

Sent to: _____

Date: _____


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M I S H R A
ARCHITECTURE PLLC

# REQUEST FOR INFORMATION

RFI #: _____

☐ Contractor ☐ Subcontractor ☐ Supplier

Name of Business: _____
Address: _____
City, State, Zip: _____
Phone: _____; Fax: _____; Email: _____

Attn: Ashish Mishra, AIA, NCARB, LEED AP
Mishra Architecture PLLC
6800 S Creek Rd, Charlotte, NC 28277; Fax: (704) 919-5822; Email: ashish@mishraarch.com

Project: _____ Place: _____ Date: _____

Drawing #: _____Specification Section: _____ Page #: _____

**Request**:

Attachments: _____

**Date Response Needed By**:

Signature: _____ Date:_____

**FOR DESIGN PROFESSIONAL USE:**
Rec'd by:_____ Date.:_____
Sent to:_____ Date: _____ Initials: _____

**Response**:

☐ Supplemental instructions do not constitute a change to the Contract.

☐ Change in scope required. This RFI to be followed by RFP No.: _____
Possible cost or time impact? Yes ☐ No ☐

Signature: _____Date:_____

Attachments: _____
Cc: _____