

## Addendum #1

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**To: All GC Candidates**  
**From: Mark Rieker**  
**Date: 8/12/14**  
**Subject: THE SKYVIEW**  
**400 Cleveland Street, Clearwater, FL 33755**

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It has come to our attention that the MEPFP Specifications were inadvertently omitted from the original specification file. These specifications have now been populated onto our ftp site under the file name: **20140811 Skyview Specs.**

Access to information: <ftp://mailhost.riekerassociates.com>  
Username: 400cleveland  
Password: condoconv2012  
Location: Private Folder/400 Cleveland/Bid and Permit Set 2014-06-27

This document shall be considered **ADDENDUM #1** for the purposes of information tracking.

The **Proposal Date shall be remain Tuesday, August 19, 2014 at noon** at which time Contractors' proposals are due.

Cc: Mr. Moises Agami – Skyview  
Mr. Alan McDonnell – Baker Barrios

**END OF ADDENDUM #1**

**THE SKYVIEW CONDOMINIUMS  
400 CLEVELAND STREET  
CLEARWATER, FL 33755**

**Specification Manual**  
**Issue for Permit- April 21, 2014**

**Architect:**

**Baker Barrios Architects, Inc.**

100 E. Madison Street

Suite 100

Tampa, FL 33602

**Civil/ Landscape:**

**Synergy Civil Engineering, Inc.**

3000 Gulf to Bay Boulevard

Tampa, FL 33602

**Structural:**

**B&W Structural Designs, Inc.**

400 North Tampa Street, Suite 2660

Tampa, FL 33602

**MEPF Engineers:**

**Volt Air**

220 West 7th Avenue, #210

Tampa, FL 33602

## **TABLE OF CONTENTS**

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

011000	SUMMARY
012300	ALTERNATES
012500	SUBSTITUTION PROCEDURES
012600	CONTRACT MODIFICATION PROCEDURES
012900	PAYMENT PROCEDURES
013100	PROJECT MANAGEMENT AND COORDINATION
013200	CONSTRUCTION PROGRESS DOCUMENTATION
013233	PHOTOGRAPHIC DOCUMENTATION
013300	SUBMITTAL PROCEDURES
014000	QUALITY REQUIREMENTS
015000	TEMPORARY FACILITIES AND CONTROLS
016000	PRODUCT REQUIREMENTS
017300	EXECUTION
017700	CLOSEOUT PROCEDURES
017823	OPERATION AND MAINTENANCE DATA
017839	PROJECT RECORD DOCUMENTS
017900	DEMONSTRATION AND TRAINING

### **DIVISION 02 – EXISTING CONDITIONS**

024119	SELECTIVE DEMOLITION
--------	----------------------

### **DIVISION 03 - CONCRETE**

035216	LIGHTWEIGHT INSULATING CONCRETE
--------	---------------------------------

### **DIVISION 05 - METALS**

055000	METAL FABRICATIONS
055113	METAL PAN STAIRS
055213	PIPE AND TUBE RAILINGS
057300	DECORATIVE METAL RAILINGS
057313	GLAZED DECORATIVE METAL RAILINGS

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

061000	ROUGH CARPENTRY
061533	WOOD PATIO DECKING
061600	SHEATHING
062023	INTERIOR FINISH CARPENTRY
064113	WOOD-VENEER-FACED ARCHITECTURAL CABINETS
064600	WOOD TRIM

**DIVISION 07 - THERMAL AND MOISTURE PROTECTION**

070150.19	PREPARATION FOR REROOFING
071413	PLAZA DECK WATERPROOFING AND DECK PAVER SYSTEM
071416	COLD FLUID-APPLIED WATERPROOFING
071700	BENTONITE WATERPROOFING
071800	TRAFFIC COATINGS
072100	BUILDING INSULATION
075216	MODIFIED BITUMINOUS MEMBRANE ROOFING
076200	SHEET METAL FLASHING AND TRIM
078100	APPLIED FIREPROOFING
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
083213	SLIDING ALUMINUM-FRAMED GLASS DOORS
084113	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
084229.23	SLIDING AUTOMATIC ENTRANCES
084413	GLAZED ALUMINUM CURTAIN WALLS
085113	ALUMINUM WINDOWS
087100	DOOR HARDWARE
088000	GLAZING
088300	MIRRORS
089119	FIXED LOUVERS
089516	WALL VENTS

**DIVISION 09 - FINISHES**

092116.23	GYPSUM BOARD SHAFT WALL ASSEMBLIES
092216	NON-STRUCTURAL METAL FRAMING
092400	PORTLAND CEMENT PLASTERING
092900	GYPSUM BOARD
093000	TILING
095113	ACOUSTICAL PANEL CEILINGS
095143	ACOUSTICAL WOOD PANEL CEILINGS
096566	RESILIENT ATHLETIC FLOORING
096813	TILE CARPETING
099100	PAINTING

**DIVISION 10 - SPECIALTIES**

101419	DIMENSIONAL LETTER SIGNAGE
102113	TOILET COMPARTMENTS
102600	WALL AND DOOR PROTECTION
102800	TOILET AND BATH ACCESSORIES
102819	GLASS SHOWER DOOR ASSEMBLIES
104413	FIRE EXTINGUISHER CABINETS
104416	FIRE EXTINGUISHERS
105143	WIRE MESH STORAGE LOCKERS
105500	MAILBOXES
105711	CLOSET SYSTEMS

**DIVISION 11 - EQUIPMENT**

111200	PARKING CONTROL EQUIPMENT
113100	RESIDENTIAL APPLIANCES
118226	WASTE COMPACTORS

**DIVISION 12 – FURNISHINGS**

123530	MANUFACTURED CASEWORK
123661	SIMULATED STONE COUNTERTOPS

**DIVISION 14 - CONVEYING EQUIPMENT**

142100	ELEVATORS
144111	POOL LIFTS
144200	WHEELCHAIR LIFTS
149182	TRASH CHUTES

**DIVISION 21 – FIRE PROTECTION**

211000	Diesel Fire Pump - Fire Protection
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**DIVISION 22 – PLUMBING**

220523	Valves, Cocks & Specialties For Plumbing Systems
220700	Insulation For Plumbing Systems
221113	Water Distribution Piping
221116	Plumbing
221119	Domestic Cold & Hot Water Supply Piping & Hot Water Circulating Piping
221123	Domestic Water Booster Pump
221316	Sanitary Sewer, Storm Water & Sanitary Vent Piping
221317	Cleanouts & Cleanout Access Covers
221319	Floor Drains & Shower Drains
221321	Drainage & Vent Systems

221426	Roof Drains
221600	Natural Gas Piping System
223330	Domestic Water Heaters, Residential Electric
223405	Domestic Water Heaters, Commercial Electric
224000	Plumbing Fixtures
224005	Plumbing Fixtures & Trim

## **DIVISION 23 - HVAC**

230100	GENERAL MECHANICAL PROVISIONS
230500	BASIC MECHANICAL MATERIALS AND METHODS
230515	INSTRUCTIONS AND MAINTENANCE MANUALS
230516	HOUSEKEEPING PADS, CONCRETE
230518	PIPING: CONDENSATE DRAIN
230519	GAUGES
230520	PIPING SYSTEMS: FLUSHING AND CLEANING
230521	THERMOMETERS
230522	FLOW STATIONS, VENTURI TYPE
230523	VALVES, COCKS, AND SPECIALTIES: HVAC SYSTEMS
230524	AIR CONTROL EQUIPMENT, HYDRONIC SYSTEMS
230529	HANGERS AND SUPPORTS
230535	ELECTRIC MOTORS, HIGH EFFICIENCY TYPE
230548	VIBRATION ISOLATION EQUIPMENT
230553	IDENTIFICATION OF PIPING SYSTEMS AND EQUIPMENT
230700	INSULATION, HVAC
230925	VARIABLE FREQUENCY DRIVE
232113	PIPING SYSTEMS: HVAC, WATER
232125	PUMPS, HORIZONTAL BASE MOUNTED END SUCTION
232313	REFRIGERANT PIPE, VALVES AND SPECIALTIES
232500	WATER TREATMENT SYSTEMS: CHILLED WATER AND CONDENSER
WATER	
233100	DUCTWORK
233300	DUCT SYSTEM ACCESSORIES
233314	DAMPERS: FIRE AND FIRE/SMOKE
233425	FANS: IN-LINE CENTRIFUGAL, LIGHT DUTY
233428	FANS - CENTRIFUGAL ROOF UPBLAST
233429	FANS: CENTRIFUGAL, CEILING MOUNTED
233713	AIR DISTRIBUTION DEVICES
233724	ROOF AIR INTAKES AND RELIEF VENTS
233725	LOUVERS
235223	BOILERS: HOT WATER, CAST IRON, GAS FIRED
235719	HEAT EXCHANGERS: PLATE TYPE
236513	COOLING TOWERS, PACKAGED, INDUCED DRAFT, STAINLESS STEEL
238131	DUCTLESS SPLIT-SYSTEM AIR-CONDITIONING UNITS

238144	AIR CONDITIONING UNITS, PACKAGED ROOFTOP
238146	AIR CONDITIONING UNITS: HEAT PUMP, WATER COOLED

**DIVISION 26 – ELECTRICAL**

260080	TESTS AND PERFORMANCE VERIFICATION
260500	BASIC ELECTRICAL REQUIREMENTS
260519	WIRES AND CABLES
260526	GROUNDING
260533	OUTLET BOXES
260539	RACEWAYS AND CONDUIT
262413	DISTRIBUTION SWITCHBOARDS
262416	PANELBOARDS
262420	SAFETY SWITCHES
262726	WIRING DEVICES
264100	LIGHTNING PROTECTION
264313	SURGE PROTECTION DEVICES
265100	LIGHTING
263213.13	EMERGENCY GENERATOR
263623	AUTOMATIC TRANSFER SWITCH

**DIVISION 27 –**

275114	EMERGENCY CALL SYSTEM
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**DIVISION 28– FIRE ALARM**

283111	ADDRESSABLE FIRE ALARM SYSTEM
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**DIVISION 31 - EARTHWORK**

313116	TERMITE CONTROL
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**DIVISION 32 – EXTERIOR IMPROVEMENTS**

321400	UNIT PAVING
321813	ARTIFICIAL TURF

END OF TABLE OF CONTENTS

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by the Contract Documents.
3. Access to site.
4. Specification and drawing conventions.

#### 1.2 PROJECT INFORMATION

- A. Project Identification: Skyview Condominiums, Tampa, FL
- B. Owner:
- C. Architect: Baker Barrios Architects, 100 E. Madison St., Suite 100, Tampa, FL 33602

#### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this Project is defined by the Contract Documents.
- B. Type of Contract:
1. Project will be constructed under a single prime contract.

#### 1.4 ACCESS TO SITE

- A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.



## 1.5 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
  - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on the Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

## SECTION 012300 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for alternates.

#### 1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### 1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Exterior Glass

1. Description: Provide a total cost figure to substitute impact resistant laminated glass for impact resistant insulated/laminated glass for Curtain Wall and Storefront systems.

END OF SECTION 012300

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for substitutions.

#### 1.2 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.3 SUBMITTALS

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

1. Substitution Request Form: Use Form attached.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
  - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
  - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
  - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 10 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or 10 days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

#### 1.4 QUALITY ASSURANCE

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

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 10 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Requested substitution will not adversely affect Contractor's construction schedule.
  - c. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - d. Requested substitution is compatible with other portions of the Work.
  - e. Requested substitution has been coordinated with other portions of the Work.
  - f. Requested substitution provides specified warranty.
  - g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 10 days after the Notice to Proceed.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - b. Requested substitution does not require extensive revisions to the Contract Documents.
  - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - d. Requested substitution will not adversely affect Contractor's construction schedule.
  - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - f. Requested substitution is compatible with other portions of the Work.
  - g. Requested substitution has been coordinated with other portions of the Work.
  - h. Requested substitution provides specified warranty.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

**SUBSTITUTION  
REQUEST**  
**(After the Bidding Phase)**

Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
\_\_\_\_\_  
From: \_\_\_\_\_  
To: \_\_\_\_\_ Date: \_\_\_\_\_  
\_\_\_\_\_  
A/E Project Number: \_\_\_\_\_  
Re: \_\_\_\_\_ Contract For: \_\_\_\_\_

Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_  
Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

Proposed Substitution: \_\_\_\_\_  
Manufacturer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
Trade Name: \_\_\_\_\_ Model No.: \_\_\_\_\_  
Installer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs old ☐ More than 10 years old

Differences between proposed substitution and specified product: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: \_\_\_\_\_  
\_\_\_\_\_

Similar Installation:  
Project: \_\_\_\_\_ Architect: \_\_\_\_\_  
Address: \_\_\_\_\_ Owner: \_\_\_\_\_  
\_\_\_\_\_ Date Installed: \_\_\_\_\_

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain \_\_\_\_\_  
\_\_\_\_\_

Savings to Owner for accepting substitution: \_\_\_\_\_ (\$ \_\_\_\_\_).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] \_\_\_\_\_ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ \_\_\_\_\_



## SUBSTITUTION REQUEST (Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: \_\_\_\_\_

Signed by: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

Attachments: \_\_\_\_\_

### A/E's REVIEW AND ACTION

- ☐ Substitution approved - Make submittals in accordance with Specification Section 013300.  
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 013300.  
☐ Substitution rejected - Use specified materials.  
☐ Substitution Request received too late - Use specified materials.

Signed by: \_\_\_\_\_

Date: \_\_\_\_\_

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ \_\_\_\_\_

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

#### 1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

#### 1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. After receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

#### 1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

#### 1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

## 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.
  - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of 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. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Submit draft of AIA Document G703 Continuation Sheets.
  - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
  - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  - 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. 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.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Progress payments shall be submitted to Architect by the 15 of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- D. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
  2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

- 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.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- 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.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of Values.
  3. Contractor's Construction Schedule (preliminary if not final).
  4. Schedule of unit prices.
  5. Submittals Schedule (preliminary if not final).
  6. List of Contractor's staff assignments.
  7. List of Contractor's principal consultants.
  8. Copies of building permits.
  9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  10. Initial progress report.
  11. Report of preconstruction conference.
  12. Certificates of insurance and insurance policies.
- I. 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.
- J. 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900



## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Coordination Drawings.
  - 2. Project meetings.
  - 3. Requests for Interpretation (RFIs).
- B. See Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

#### 1.2 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

#### 1.3 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.

#### 1.4 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:
    - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - b. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
  - 2. Sheet Size: At least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
  - 3. Number of Copies: Submit five (5) copies of each submittal. Architect and Consultants will each retain one copy.
  - 4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

## 1.5 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. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Preparation of Record Documents.
    - l. Use of the premises.
    - m. Work restrictions.
    - n. Owner's occupancy requirements.
    - o. Responsibility for temporary facilities and controls.
    - p. Construction waste management and recycling.
    - q. Parking availability.
    - r. Office, work, and storage areas.
    - s. Equipment deliveries and priorities.

- t. First aid.
  - u. Security.
  - v. Progress cleaning.
  - w. Working hours.
3. Minutes: Record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written recommendations.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at weekly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Work hours.
      - 10) Hazards and risks.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Status of correction of deficient items.
      - 14) Field observations.
      - 15) RFIs.
      - 16) Status of proposal requests.
      - 17) Pending changes.
      - 18) Status of Change Orders.
      - 19) Pending claims and disputes.
      - 20) Documentation of information for payment requests.

3. Minutes: Record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

#### 1.6 REQUESTS FOR INTERPRETATION (RFIs)

- 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.
  1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
  1. Project name.
  2. Date.
  3. Name of Contractor.
  4. Name of Architect.
  5. RFI number, numbered sequentially.
  6. Specification Section number and title and related paragraphs, as appropriate.
  7. Drawing number and detail references, as appropriate.
  8. Field dimensions and conditions, as appropriate.
  9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  10. Contractor's signature.
  11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
- C. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
  1. The following RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents.

- d. Requests for adjustments in the Contract Time or the Contract Sum.
  - e. Requests for interpretation of Architect's actions on submittals.
  - f. Incomplete RFIs or RFIs with numerous errors.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
- 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
  - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- D. 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.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.
  - 1. Project name.
  - 2. Name and address of Contractor.
  - 3. Name and address of Architect.
  - 4. RFI number including RFIs that were dropped and not submitted.
  - 5. RFI description.
  - 6. Date the RFI was submitted.
  - 7. Date Architect's response was received.
  - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  - 9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Contractor's Construction Schedule.
  - 2. Submittals Schedule.
  - 3. Daily construction reports.
  - 4. Field condition reports.
- B. See Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
- C. See Division 01 Section "Photographic Documentation" for submitting construction photographs.

#### 1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.



- E. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- F. Major Area: A story of construction, a separate building, or a similar significant construction element.

### 1.3 SUBMITTALS

- A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
  - 1. Scheduled date for first submittal.
  - 2. Specification Section number and title.
  - 3. Submittal category (action or informational).
  - 4. Name of subcontractor.
  - 5. Description of the Work covered.
  - 6. Scheduled date for Architect's final release or approval.
- B. Preliminary Network Diagram: Submit two opaque copies, large enough to show entire network for entire construction period. Show logic ties for activities.
- C. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
  - 1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
- D. CPM Reports: Concurrent with CPM schedule, submit three copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  - 3. Total Float Report: List of all activities sorted in ascending order of total float.
- E. Daily Construction Reports: Submit two copies at weekly intervals.
- F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

## 1.4 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from parties involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule prior to commencement of construction. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
  - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
  - 2. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

### 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

4. Startup and Testing Time: Include not less than 30 days for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  5. Work Stages: Indicate important stages of construction for each major portion of the Work.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

## 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Preliminary Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

- C. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized, cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  3. Use "one workday" as the unit of time. Include list of nonworking days and holidays incorporated into the schedule.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and commissioning.
  2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- E. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Principal events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.

## 2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. Equipment at Project site.
  3. Material deliveries.
  4. High and low temperatures and general weather conditions.
  5. Accidents.
  6. Stoppages, delays, shortages, and losses.
  7. Meter readings and similar recordings.
  8. Orders and requests of authorities having jurisdiction.
  9. Services connected and disconnected.
  10. Equipment or system tests and startups.
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

## SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Administrative and procedural requirements for the following:
    - a. Preconstruction photographs.
    - b. Periodic construction photographs.
- B. See Division 01 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.
- C. See Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.

#### 1.2 SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same label information as corresponding set of photographs.
- B. Construction Photographs: Submit two prints of each photographic view within seven days of taking photographs.
  - 1. Format: 8-by-10-inch smooth-surface matte prints on single-weight commercial-grade photographic paper, mounted on linen or card stock to allow a 1-inch- wide margin and enclosed back to back in clear plastic sleeves that are punched for standard 3-ring binder.
  - 2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
    - a. Name of Project.
    - b. Name and address of photographer.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Date photograph was taken if not date stamped by camera.
    - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    - g. Unique sequential identifier.

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

### 1.3 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

### 1.4 COORDINATION

- A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

### 1.5 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

## PART 2 - PRODUCTS

### 2.1 PHOTOGRAPHIC MEDIA

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

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified commercial photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
  1. Maintain key plan with each set of construction photographs that identifies each photographic location.



C. Film Images:

1. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
2. Field Office Prints: Retain one set of prints of progress photographs in the field office at Project site, available at all times for reference. Identify photographs same as for those submitted to Architect.

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

1. Date and Time: Include date and time in filename for each image.
2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

E. Preconstruction Photographs: Before commencement of excavation, take, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag excavation areas and construction limits before taking construction photographs.
2. Take eight photographs to show existing conditions adjacent to property before starting the Work.
3. Take eight photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

F. Periodic Construction Photographs: Take 12, digital photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

G. Additional Photographs: Architect may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:
  - a. Special events planned at Project site.
  - b. Immediate follow-up when on-site events result in construction damage or losses.
  - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.

- d. Substantial Completion of a major phase or component of the Work.
- e. Extra record photographs at time of final acceptance.
- f. Owner's request for special publicity photographs.

END OF SECTION 013233

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

#### 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

#### 1.3 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 requires sequential activity.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- B. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- 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.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Allow 15 days for processing each resubmittal.
  3. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 4 by 5 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name and address of supplier.
    - g. Name of manufacturer.
    - h. Unique identifier, including revision number.
    - i. Number and title of appropriate Specification Section.
    - j. Drawing number and detail references, as appropriate.
    - k. Other necessary identification.
- E. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions of the Contract Documents, initial submittal may serve as final submittal.
1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form attached at the end of this Section. Architect will return submittals, without review, received from sources other than Contractor.
1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.
  2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies: Submit six (6) copies of each submittal, unless otherwise indicated. Architect and Consultants will mark up and retain one returned copy as a Project Record Document.
  2. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:
    - a. Initial Submittal: Submit a preliminary single copy of each submittal where selection of options, color, pattern, texture, or similar characteristics is required. Architect will return submittal with options selected.
    - b. Final Submittal: Submit six (6) copies. Architect will retain one copy; remainder will be returned. Mark up and retain one returned copy as a Project Record Document.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts.
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Mill reports.
    - j. Standard product operating and maintenance manuals.
    - k. Compliance with recognized trade association standards.
    - l. Compliance with recognized testing agency standards.
    - m. Application of testing agency labels and seals.
    - n. Notation of coordination requirements.

- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shopwork manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Design calculations.
    - j. Compliance with specified standards.
    - k. Notation of coordination requirements.
    - l. Notation of dimensions established by field measurement.
  2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  3. Number of Copies: Submit six (6) copies. Architect and Consultants will retain one copy each.
- D. Coordination Drawings: Comply with requirements in Division 01 Section "Project Management and Coordination."
- E. Samples: Prepare physical units of materials or products, including the following:
1. Comply with requirements in Division 01 Section "Quality Requirements" for mockups.
  2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
  3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:
    - a. Generic description of Sample.

- b. Product name or name of manufacturer.
  - c. Sample source.
5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
- a. Size limitations.
  - b. Compliance with recognized standards.
  - c. Availability.
  - d. Delivery time.
6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
- a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
  - b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
7. Number of Samples for Initial Selection: Submit two full set[s] of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
8. Number of Samples for Verification: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
- a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
9. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
  - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

- F. Product Schedule or List: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  - 1. Type of product. Include unique identifier for each product.
  - 2. Number and name of room or space.
  - 3. Location within room or space.
- G. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation."
- H. Application for Payment: Comply with requirements in Division 01 Section "Payment Procedures."
- I. Schedule of Values: Comply with requirements in Division 01 Section "Payment Procedures."
- J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
  - 1. Number of Copies: Submit four (4) copies of each submittal, unless otherwise indicated.
  - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  - 3. Test and Inspection Reports: Comply with requirements in Division 01 Section "Quality Requirements."
- B. Contractor's Construction Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.



- D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- J. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- K. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- L. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- M. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- N. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.

5. Description of product.
  6. Test procedures and results.
  7. Limitations of use.
- O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 01 Section "Closeout Procedures."
- P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
  2. Required substrate tolerances.
  3. Sequence of installation or erection.
  4. Required installation tolerances.
  5. Required adjustments.
  6. Recommendations for cleaning and protection.
- R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- T. Construction Photographs: Comply with requirements in Division 01 Section "Photographic Documentation."

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. General: Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
  - 1. No Exceptions Taken - Final Unrestricted Release: When submittals are marked "No Exceptions Taken", that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  - 2. Revise and Resubmit - Returned for Resubmittal: When submittal is marked "Revise and Resubmit", do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
  - 3. Rejected; Submit Specified Item: When submittal is marked "Rejected; Submit specified item", do not proceed with that part of the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance in accordance with the notations, resubmit without delay.
  - 4. Exceptions as Noted - Final-But-Restricted Release: When submittals are marked "Exceptions as Noted", that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and with requirements of the Contract Documents; final acceptance will depend upon that compliance

- 5. No Action Taken - Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked "No Action Taken".
- C. Informational Submittals: Architect will review each submittal and will return it, or will reject and return it if it does not comply with requirements. Architect will forward submittal to appropriate party.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

#### PART 4 - EXECUTION

##### 4.1 SUBMITTAL TRANSMITTAL FORM

- A. Submittal Transmittal Form: Refer to the following form.



ARCHITECTURE  
INTERIOR DESIGN

**TAMPA**  
100 E. Madison Street  
Suite 100  
Tampa, FL 33602  
Phone: 813.549.1900  
Fax: 813.549.1901  
AA0002981

**SPECIALIZED MARKETS**  
Commercial  
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Hospitality  
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Health Care  
Entertainment

**WEB SITE**  
www.bakerbarrios.com

### Submittal Transmittal Form

Contractor:	Owner:
Name:	
Project Name:	Project No.:
	Spec Section No.:

<b>SUBCONTRACTOR/SUPPLIER</b> _____ _____ _____ <b>Date:</b> _____ <b>Copies:</b> _____ <b>Substitution or Deviations:</b> Yes <input type="checkbox"/> No <input type="checkbox"/>	<b>DATE RECEIVED BY BBA</b>
<b>BBA TO CONSULTANT ENGINEER:</b> _____ _____ <b>ATTN:</b> _____ <b>Date:</b> _____ <b>Copies:</b> _____	<b>DATE RECEIVED BY CONSULTANT</b>
<b>CONSULTANT TO BBA</b> <b>Date:</b> _____ <b>Copies:</b> _____ <b>Reviewed by:</b> _____ <b>Comments:</b> _____ _____	<b>DATE RECEIVED BY BBA</b>
<b>BBA TO CONTRACTOR</b> <b>Date:</b> _____ <b>Copies:</b> _____ <b>Contractor:</b> _____ _____ <b>To Owner:</b> _____ <b>To Field:</b> _____ <b>To File:</b> _____	<b>DATE RECEIVED BY CONTRACTOR</b>

**ACTION TAKEN:**

- |                                                          |                                              |
|----------------------------------------------------------|----------------------------------------------|
| <input type="checkbox"/> No Exceptions Taken             | <input type="checkbox"/> Exceptions as Noted |
| <input type="checkbox"/> Revise and Resubmit             | <input type="checkbox"/> No Action Taken     |
| <input type="checkbox"/> Rejected; Submit specified item |                                              |

END OF SECTION 013300

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

#### 1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### 1.3 CONFLICTING REQUIREMENTS

- A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

#### 1.4 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
  2. Description of test and inspection.
  3. Identification of applicable standards.
  4. Identification of test and inspection methods.
  5. Number of tests and inspections required.
  6. Time schedule or time span for tests and inspections.
  7. Entity responsible for performing tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
1. Date of issue.
  2. Project title and number.
  3. Name, address, and telephone number of testing agency.
  4. Dates and locations of samples and tests or inspections.
  5. Names of individuals making tests and inspections.
  6. Description of the Work and test and inspection method.
  7. Identification of product and Specification Section.
  8. Complete test or inspection data.
  9. Test and inspection results and an interpretation of test results.
  10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.5 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.



- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 02 through 33.

## 1.6 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
  3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. 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. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. 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.

- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for the Notice to Proceed.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## 1.7 SPECIAL TESTS AND INSPECTIONS

- A. 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:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. 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.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and reinspecting corrected work.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
  2. Description of the Work tested or inspected.
  3. Date test or inspection results were transmitted to Architect.
  4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
  2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities include, but are not limited to, the following:

1. Sewers and drainage.
2. Water service and distribution.
3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
4. Heating and cooling facilities.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.

C. Support facilities include, but are not limited to, the following:

1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Project identification and temporary signs.
4. Waste disposal facilities.
5. Field offices.
6. Storage and fabrication sheds.
7. Lifts and hoists.
8. Temporary elevator usage.
9. Temporary stairs.
10. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Site enclosure fence.
6. Security enclosure and lockup.
7. Barricades, warning signs, and lights.
8. Covered walkways.
9. Temporary enclosures.
10. Temporary partitions.
11. Fire protection.

## 1.2 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

## 1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
  - 1. Owner's construction forces.
  - 2. Occupants of Project.
  - 3. Architect.
  - 4. Testing agencies.
  - 5. Personnel of authorities having jurisdiction.

## 1.4 SUBMITTALS

- A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Within 15 days of date established for submittal of CM's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

## 1.5 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
  - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
  - 2. 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.



## 1.6 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
  - 1. 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.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
  - 1. Keep temporary services and facilities clean and neat.
  - 2. Relocate temporary services and facilities as required by progress of the Work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails, with galvanized barbed-wire top strand.
- C. Portable Chain-Link Fencing: Minimum 2-inch 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete bases for supporting posts.
- D. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."
- E. Roofing: Standard-weight, mineral-surfaced, asphalt shingles or asphalt-impregnated and -coated, mineral-surfaced, roll-roofing sheet.
- F. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.
- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

- H. Paint: Comply with requirements in Division 09 Section "Painting."
- I. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.
- J. Water: Potable.

## 2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.
- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
  - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.
- F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
- G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

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

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
  - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
  - 2. Connect temporary sewers to municipal system as directed by sewer department officials.
  - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
  - 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.

- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
  2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
  3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
    - a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
  4. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.
  2. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install electric power service underground, unless overhead service must be used.
  2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
  3. Connect temporary service to Owner's existing power source, as directed by electric company officials.

- H. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.
- I. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
  2. Provide warning signs at power outlets other than 110 to 120 V.
  3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
  4. Provide metal conduit enclosures or boxes for wiring devices.
  5. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
  6. When working within the existing building, the Owner will make available electrical service within the limit of the existing building system, in order to perform work in those areas. The CM shall be responsible for providing additional electrical service for any equipment he employs, that exceeds the limit of the existing electrical service. CM shall be responsible to see that the existing electrical service is not overloaded.
- J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  2. Provide one 100-W incandescent lamp per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
  3. Provide one 100-W incandescent lamp every 50 feet in traffic areas.
  4. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
  5. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
  6. Construction Site Lighting: During hours of darkness provide perimeter lighting along line of construction fence and area lighting within construction site furnishing 1.5 footcandles of illumination at ground level. Provide 5.0 footcandles of illumination at all gates and entrances to temporary buildings and new structures under construction. Make provisions for operation of lighting during power failures and include automatic re-start.
  7. Install lighting for Project identification sign.

- K. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities. Install separate telephone line for each field office and first-aid station.
1. Provide additional telephone lines for the following:
    - a. In field office with more than two occupants, install a telephone for each additional occupant or pair of occupants.
    - b. Provide a dedicated telephone line for each facsimile machine and computer with modem in each field office.
    - c. Provide a separate telephone line for Owner's use.
    - d. Install a telephone on every second or third story of construction.
  2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. CM's office.
    - d. Architect's office.
    - e. Engineers' offices.
    - f. Owner's office.
    - g. Principal subcontractors' field and home offices.
  3. Furnish superintendent with electronic paging device and portable two-way radio for use when away from field office.
  4. Provide a portable cellular telephone for superintendent's use in making and receiving telephone calls when away from field office.
  5. Install a coin-operated telephone station at a convenient grade-level location for convenience of personnel.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
  2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
  3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas as indicated on Drawings.
1. Provide a reasonably level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95 percent of maximum dry density in the top 6 inches.
  2. Provide gravel paving course of subbase material not less than 3 inches thick; roller compacted to a level, smooth, dense surface.
  3. Temporary road to be a minimum of 4 inches (100 mm) crushed stone or equivalent to be maintained as required.
  4. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
  2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section "Earthwork."
  3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section "Hot-Mix Asphalt Paving."
- D. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
- E. Traffic Control: Posted speed limits and driving regulations will be strictly enforced by the Owner. The Owner reserves the right to take any action deemed appropriate regarding violations including, but not limited to, refusal to permit violators to enter upon or remain on the premises.
1. Escort appropriately to and from the site all large crawler or mobile cranes operating on site and take all precautions necessary to prevent damage to Owner's property during operation both on and off site.
  2. Obtain advance written authorization from Owner and local Government Authorities for all road blocks, detours and other interruptions of normal traffic flow that may be needed to facilitate construction operations.

- F. Dewatering Facilities and Drains: Comply with requirements in applicable Division 02 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
  2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
  3. Remove snow and ice as required to minimize accumulations.
- G. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
  2. Prepare temporary signs to provide directional information to construction personnel and visitors.
  3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
  4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
- H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.
1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
  2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.
- I. Janitorial Services: Provide janitorial services on a daily basis for temporary offices, first-aid stations, toilets, wash facilities, lunchrooms, and similar areas.
- J. Contractor's Field Office: Provide an insulated, weathertight, air-conditioned field office for weekly job meetings. The Office shall be of sufficient size to accommodate all personnel required to attend.
1. Furnish and equip office as required. Provide table(s), chairs, and other necessary equipment and furnishings.



- K. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.
  - 1. Construct framing, sheathing, and siding using fire-retardant-treated lumber and plywood.
  - 2. Paint exposed lumber and plywood with exterior-grade acrylic-latex emulsion over exterior primer.
- L. Temporary Access: The CM shall provide and install ramps, stairs, ladders and similar temporary access elements as required to perform the work and facilitate its inspection during installation
- M. Lifts and Hoists: Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- N. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes will be undamaged at time of acceptance.
- O. Existing Stair Usage: Use of Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
  - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

### 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. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.

- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with project mitigation measures, environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Dust Control: Sprinkle exterior demolition sites with water during demolition, excavation and construction activity; sprinkle unpaved exterior construction areas with water at least twice per day; cover stockpiles of soil, sand, and other material; cover trucks hauling debris, soil, sand or other such material; and sweep surrounding streets during demolition and construction at least once per day to reduce particulate emissions.
    - a. Ordinances require that non-potable water be used for dust control activities. Obtain reclaimed water from the Clean Water Program for this purpose.
  2. Noise Control: Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site. During demolition, construction and cleaning operations use construction equipment with state-of-the-art noise shielding and muffling devices.
    - a. Barriers: Construct barriers around stationary equipment such as compressors, which will reduce construction noise by as much as 5 dBA, and locate stationary equipment in pit areas or excavated areas which will serve as noise barriers.
- C. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.
- E. Tree and Plant Protection: Comply with requirements in Section "Tree Protection and Trimming."
- F. Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

G. Pollution Controls:

1. Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt generated by construction operations. Comply with governing environmental protection regulations.
  - a. Do not create hazardous or objectionable conditions, such as ice, flooding, and pollution, when using water.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Clean adjacent buildings and improvements of dust, dirt, and debris caused by construction operations. Return adjacent areas to condition existing before start of demolition.

H. 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.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

I. Site Maintenance and Cleaning: Provide maintenance and cleaning of entire construction site on a daily basis. Secure all construction equipment, machinery and vehicles, park and store only within fenced area, and render inoperable during non-work hours. CM is responsible to insure that no construction materials, tools, equipment, machinery or vehicles can be used for unauthorized entry or other damage or interference to activities and security of existing facilities adjacent to and in the vicinity of construction site.

J. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

K. Covered Walkway: Erect a structurally adequate, protective, covered walkway for passage of persons along adjacent public street. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Extend back wall beyond the structure to complete enclosure fence.
4. Paint and maintain in a manner approved by Owner and Architect.
5. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.

- L. 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 weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
  2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
  3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
  4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
  5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.
- M. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
1. Construct dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on construction side.
  2. Construct dustproof, floor-to-ceiling partitions of not less than nominal 4-inch studs, 2 layers of 3-mil polyethylene sheets, inside and outside temporary enclosure. Cover floor with 2 layers of 3-mil polyethylene sheets, extending sheets 18 inches up the side walls. Overlap and tape full length of joints. Cover floor with 3/4-inch fire-retardant plywood.
    - a. Construct a vestibule and airlock at each entrance to temporary enclosure with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
  3. Insulate partitions to provide noise protection to occupied areas.
  4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
  5. Protect air-handling equipment.
  6. Weatherstrip openings.
- N. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
    - a. Field Offices: Class A stored-pressure water-type extinguishers.

- b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
  - c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
- 2. Store combustible materials in containers in fire-safe locations.
  - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
  - 4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
  - 5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
  - 6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  - 7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
  - 8. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

- E. 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.
1. Materials and facilities that constitute temporary facilities are the property of CM. Owner reserves right to take possession of Project identification signs.
  2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Selection of products for use in Project
2. Product delivery, storage, and handling
3. Product substitutions and comparable products.

#### 1.2 DEFINITIONS

- A. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "Basis of Design," and includes make or model number or other designation, the purpose is to indicate the specific product or item used to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics required for use on the Project.

1. The "Basis of Design" indicated provides information for purposes of evaluating comparable products of other manufacturers that may be suitable for use on the Project and is not intended to limit competition.

- a. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.

- B. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

### 1.3 SUBMITTALS

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

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or 5 days of receipt of additional information or documentation, whichever is later.

- a. Form of Acceptance: Change Order.
- b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

### 1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

### 1.5 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.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.



6. Store materials in a manner that will not endanger Project structure.
  7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  9. Protect stored products from damage.
- B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## PART 2 - PRODUCTS

### 2.1 PRODUCT OPTIONS

- 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.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where product specifications are accompanied by the terms "to be selected" or "as selected", Architect will make selection.
  5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
  7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures: Procedures for product selection include the following:
1. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Products" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
    - a. Substitutions may be considered, unless otherwise indicated.

2. Substitutions may be considered, unless otherwise indicated  
Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
  - a. Substitutions may be considered, unless otherwise indicated.
3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
  - a. Substitutions may be considered, unless otherwise indicated.
4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
  - a. Substitutions may be considered, unless otherwise indicated.
5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
6. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.
  - a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.
7. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.
  - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
  - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 PRODUCT SUBSTITUTIONS

- A. Architect will consider requests for substitution.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
  - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 3. Substitution request is fully documented and properly submitted.
  - 4. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 5. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 6. Requested substitution is compatible with other portions of the Work.
  - 7. Requested substitution has been coordinated with other portions of the Work.
  - 8. Requested substitution provides specified warranty.
  - 9. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

## 2.3 COMPARABLE PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
  - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

#### 1.2 SUBMITTALS

- A. Qualification Data: For professional engineer to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

#### 1.3 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

### PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
  - 1. Before construction, verify the location and points of connection of utility services.
- B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Utility Interruptions: Do not interrupt utilities serving facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Do not proceed with utility interruptions without Architect's or Owner's written permission.

- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect on Contractor's form. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

### 3.4 FIELD ENGINEERING

- A. Identification: Owner will provide property survey and identify existing benchmarks, control points, and property corners.
  - 1. Bench Marks: Two permanent benchmarks established on Project Site.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 degrees F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.



2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
  1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

### 3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturers written instructions for temperature and relative humidity.

### 3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

#### 1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of 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. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Architect of changeover utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. 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 that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

### 1.3 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 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.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.
- 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

### 1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of Contractor's list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

3. Include the following information at the top of each page:

- a. Project name.
- b. Date.
- c. Name of Owner and Architect.
- d. Name of Contractor.
- e. Page number.

1.5 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

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. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - d. 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.
    - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - f. Sweep concrete floors broom clean in unoccupied spaces.
    - g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    - h. 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.
    - i. Remove labels that are not permanent.
    - j. 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.
    - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - l. Replace parts subject to unusual operating conditions.
    - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - o. Clean ducts, blowers, and coils if units were operated without filters during construction.

- p. 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.
  - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. 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 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems, and equipment.

#### 1.2 SUBMITTALS

- A. Submittals: Submit one copy of each manual in final form at least 15 days before final inspection. Owner's Representative will return copy with comments within 15 days after final inspection.
1. Correct or modify each manual to comply with Owner's Representative's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Owner's Representative's comments.

### PART 2 - PRODUCTS

#### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
1. List of documents.
  2. List of systems.
  3. List of equipment.
  4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.



- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

## 2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor.
  - 6. Name and address of Architect.
  - 7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
  5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.

- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.

6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.

3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

## 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

### PART 3 - EXECUTION

#### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- C. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

- D. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
1. Do not use original Project Record Documents as part of operation and maintenance manuals.
  2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

#### 1.2 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set(s) of marked-up Record Prints.

B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

### PART 2 - PRODUCTS

#### 2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings on the project site at all times.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
  - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
  - b. Accurately record information in an understandable drawing technique.
  - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.



2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Owner's Representative's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect and Owner.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  5. Note related Change Orders and Record Drawings where applicable.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Owner's Representative's reference during normal working hours.

END OF SECTION 017839

## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Administrative and procedural requirements for instructing Owner's personnel. The General Contractor shall train the Owner's personnel in the operation and maintenance of equipment specified. Training shall include, but not be limited to, the following:
  - a. Demonstration of operation of systems, subsystems, and equipment.
  - b. Training in operation and maintenance of systems, subsystems, and equipment.

#### 1.2 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
1. At completion of training, submit one complete training manual for Owner's use.
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.
- E. Demonstration and Training Videotape: Training sessions shall be videotaped. Submit two copies at end of each training module.
- F. Additional Training: Provide additional training when requested by the Owner.

### 1.3 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

### 1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## PART 2 - PRODUCTS

### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, including, but not limited to, the following:
  - 1. Motorized doors, including overhead coiling doors and automatic entrance doors.
  - 2. Equipment, including projection screens, loading dock equipment, and food-service equipment.
  - 3. Fire-protection systems, including fire alarm, fire pumps, and fire-extinguishing systems.

4. Intrusion detection systems.
  5. Conveying systems, including elevators.
  6. Refrigeration systems.
  7. HVAC systems, including air-handling equipment air distribution systems and terminal equipment and devices.
  8. HVAC instrumentation and controls.
  9. Electrical service and distribution, including transformers switchboards panelboards uninterruptible power supplies and motor controls.
  10. Packaged engine generators, including transfer switches.
  11. Lighting equipment and controls.
  12. Communication systems, including intercommunication surveillance clocks and programming voice and data and television equipment.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project Record Documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
  - a. Startup procedures.
  - b. Equipment or system break-in procedures.
  - c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
  - a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.

- B. Set up instructional equipment at instruction location.

### 3.2 INSTRUCTION

- A. The General Contractor shall engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

- 1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
  - 3. Owner will furnish Contractor with names and positions of participants.

- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

- 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

- C. Demonstration and Training Videotape: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

- 1. At beginning of each training module, record each chart containing learning objective and lesson outline.

- D. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

## SECTION 024119 - SELECTIVE DEMOLITION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of building components and materials.
2. Disconnecting, capping or sealing, abandoning in-place and removing site utilities.

#### 1.2 DEFINITIONS

- A. Demolish: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and reinstalled.
- B. Remove and Store: Detach items from existing construction and deliver them to Owner's on site storage area ready to be reinstalled.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed or removed and reinstalled.

#### 1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.4 SUBMITTALS

- A. Proposed Protection Measures: Submit informational report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.



B. Schedule of Building Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Coordination of Owner's continuing occupancy of portions of existing building.
5. Means of protection for items to remain and items in path of waste removal from building site.

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by building demolition operations. Submit before the Work begins.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.
- C. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
1. Review methods and procedures for vermin eradication and cleanup.
  2. Inspect and discuss condition of construction to be demolished.
  3. Review structural load limitations of existing structures.
  4. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  5. Review and finalize protection requirements.
  6. Review procedures for noise control and dust control.
  7. Review procedures for protection of adjacent buildings.

1.6 PROJECT CONDITIONS

- A. Owner assumes no responsibility for buildings and structures to be demolished.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. On-site storage or sale of removed items or materials is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.
- F. Building exclusion and rodent eradication and removal shall be completed prior to the beginning of Selective Structural Demolition operations.

#### 1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.
- G. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off indicated utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
    - a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces, to prevent water leakage and damage to structure and interior areas.
  - 3. Comply with requirements specified in Division 01 Section "Temporary Facilities and Controls."

- C. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
1. Owner will arrange to shut off indicated utilities when requested by Contractor.
  2. Arrange to shut off indicated utilities with utility companies.
  3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
  4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of demolition.

### 3.4 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
  2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
    - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.
- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities and Controls."
1. Protect adjacent buildings and facilities from damage due to demolition activities.
  2. Protect existing site improvements, appurtenances, and landscaping to remain.
  3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
  4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
  6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
  7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.5 DEMOLITION, GENERAL

- A. General: Demolish indicated existing building components and materials completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
  2. Maintain fire watch after flame cutting operations.
  3. Maintain adequate ventilation when using cutting torches.
  4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Removed and Stored and Reinstalled Items:
1. Pack or crate items as directed by the Owner. Identify contents of containers.
  2. Store items as directed by the Owner.
  3. Transport items to Owner's storage area on-site.
  4. Protect items from damage during transport and storage.
- C. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Reinstall items in locations indicated. Comply with installation requirements for new materials. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- E. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

- F. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
2. Limit spread of dust and dirt. Comply with governing environmental-protection regulations.

### 3.6 DEMOLITION BY MECHANICAL MEANS

- A. Remove debris from building in a controlled manner.
- B. Existing Utilities: Demolish and remove existing indicated.
1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
  2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

### 3.7 REPAIRS

- A. Promptly repair damage to adjacent buildings caused by demolition operations.

### 3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.9 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 024119

## SECTION 035216 - LIGHTWEIGHT INSULATING CONCRETE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Lightweight concrete roof insulation.
  2. Lightweight insulating concrete.
  3. Insulation board.

#### 1.2 DEFINITIONS

- A. Insulating Concrete Roof Insulation: Low-density concrete, with an oven-dry unit weight not exceeding 50 lb/cu. ft., placed with or without embedded rigid insulation, and classified as follows:
1. Cellular Insulating Concrete: Low-density concrete made with portland cement, water, and air-producing foaming agents.

#### 1.3 CODE COMPLIANCE

- A. Insulating concrete roof insulation system shall comply with the Florida Building Code.
1. Provide product evaluation and installation requirements indicating compliance with wind criteria indicated.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Design Wind Speed: As shown on the Structural documents.
- B. Material Compatibility: Insulating concrete roof deck system shall be approved by and be compatible with the membrane roofing system specified.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product specified. Include mixing and application instructions for each type of insulating concrete.
1. Include insulating concrete design designations of a qualified testing and inspecting agency evidencing compliance with requirements.



- B. Shop Drawings: Include plans, sections, and details showing roof slopes, insulation thickness, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.
- C. Design Mixes: For each insulating concrete mix, including as-cast unit weight, and compressive strength.
- D. Material Test Reports: From a qualified independent testing agency evidencing compliance with requirements of the following based on comprehensive testing of current materials:
  - 1. Thermal insulation value per ASTM C 177
  - 2. Mix design compressive strength per ASTM C 796
  - 3. Mix design wet and dry density range per ASTM C 796
  - 4. Expanded polystyrene (EPS) density per ASTM C 578
- E. Material Certificates: In lieu of agency test reports, when permitted by Architect, signed by insulating concrete manufacturer certifying that each material item complies with requirements.
- F. Research Reports or Evaluation Reports: Submit the following reports showing insulating concrete's compliance with the following testing agency and building code jurisdiction:
  - 1. Submit Factory Mutual Approval of specified construction assembly to meet specified wind uplift requirements. Evaluation reports from other testing agencies will not be accepted.
  - 2. Submit current State Product Approval certification.
  - 3. Submit a sample copy of the warranty covering the proposed insulating concrete system.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage a certified, experienced Installer who has completed insulating concrete work similar in material, design, and extent to that indicated for this Project and who is acceptable to and certified by the manufacturer of primary materials.
  - 1. Installer shall provide manufacturer's written certification stating that the installer has the knowledge expertise to complete the Project as designed and specified.
  - 2. Installer shall have a minimum five years of trouble free experience on similar type work.
- B. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1077 and ASTM E 329, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

- C. Fire-Test-Response Characteristics: Where indicated, provide insulating concrete identical to that tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance Ratings: As indicated by design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
- D. FM Listing: Provide insulating concrete evaluated by Factory Mutual as part of a roof assembly and listed in FM Research Corp.'s "Approval Guide", as follows:
  - 1. Fire Rating: Class 1.
  - 2. Windstorm Rating: Minimum FM Class 1-120. Greater if designed by the engineer of record, but not less than FM Class 1-120.
- E. Fastener Pull Testing: Provide documentation and written report approved by the roof membrane manufacturer verifying fastener pull testing complies with the Florida Building Code, Dade County, and FM requirements for the installation of the modified bituminous roofing system.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.
- B. Store packaged materials to protect them from elements or physical damage.
- C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

#### 1.8 PROJECT CONDITIONS

- A. General: Comply with manufacturer's instructions and recommendations.

#### 1.9 ROOF SYSTEM GUARANTEE

- A. Roof System Guarantee: Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with the roofing system manufacturer's twenty (20) year warranty. The insulation system warranty shall include the composite roof deck system consisting of insulating cellular concrete and polystyrene insulation panels. All repair or replacement costs covered under the guarantee shall be borne by the insulating concrete installer. The guarantee shall be a no dollar limit term type, without deductibles or limitations on coverage amount, and be issued at no additional cost to the Owner. Specific items covered during the term of the insulation system warranty include:

1. The actual resistance to heat flow through the roof insulation will be at least 90% of the design thermal resistance.
    - a. Calculations for resistance to heat flow may include inside and outside air films and roof membrane.
  2. The roof insulation will remain in a re-roofable condition should the roof membrane require replacement (excluding damage caused by fastener pullout during removal of the old membrane.)
  3. The Insulating Concrete Warranty will not limit, by geographic location, the owner's rights for claims, actions, and/or proceedings.
  4. The roof insulation material will not cause structural damage to the building as a result of expansion from thermal or chemical action.
- B. Special Project Warranty: Submit Installer's warranty covering Work of this Section for the following warranty period:
1. Warranty Period: 2 years from date of Substantial Completion.
- C. Refer to Specification 075200, Modified Bituminous Membrane Roofing for roof system guarantee requirements.

## 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:
1. Lightweight (Cellular) Insulating Concrete:
    - a. Celcore Inc.
    - b. Concrecel USA

### 2.2 LIGHTWEIGHT INSULATING CONCRETE

- A. General: Design mix to produce lightweight concrete roof insulation with the following minimum physical properties using the minimum amount of water necessary to produce a workable mix.
1. Cast Density: 34 to 42-lb/cu. ft. at point of placement, when tested according to ASTM C 796.
  2. Dry Density: 27 to 32-lb/cu. ft., when tested according to ASTM C 796.
  3. Compressive Strength: Minimum 300 psi, when tested according to ASTM C 796.
- B. Performance R-Value: Minimum R-value indicated as an average overall roof R-Value.

## 2.3 MATERIALS

- A. Portland Cement: ASTM C 150, Type I, Type II, or Type III.
- B. Insulation Board: Expanded polystyrene insulation board having a nominal density of one pound per cubic foot defined as Type 1 by ASTM C 578 and containing approximately 3% open area. The insulation shall carry the Factory Mutual approval label and the Underwriters Laboratories Classified label.
- C. Foaming Agent: ASTM C 869 and ASTM C 796.
- D. Water: Clean, potable and free of deleterious amounts of acid, alkali, and organic materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. General: Comply with materials manufacturer's instructions and recommendations regarding surface preparation, cleaning or other corrective measures to insure surfaces to receive insulating concrete are acceptable to the installer.
  - 1. Do not begin placement of materials until surfaces are acceptable to the installer.

### 3.2 MIXING AND PLACING

- A. General: Install insulating concrete materials according to manufacturer's recommendations. Mix and place insulating concrete according to manufacturer's instructions, using equipment and procedures to avoid segregation of mix and loss of air content.
  - 1. Install the Lightweight Insulation System to provide for an average/minimum thermal value of R-22, unless otherwise indicated. The minimum R-value at all roof drains shall not be less than an R-10.
  - 2. Install the system to provide for a minimum positive roof slope of 1/4 inch per foot and tapered crickets at 1/2-inch per foot. Provide sumps around roof drains indicated; minimum 4' x 4' dimension. See the structural drawings for slope provided by the roof framing system.
  - 3. Avoid rooftop traffic over the roof insulation system until one can walk over the surface without creating surface damage.
  - 4. No ponding water will be permitted.

### 3.3 FIELD QUALITY CONTROL

- A. The presence of water at the top of the concrete deck, within the insulation or in the lightweight insulating concrete fill beyond the maximum allowable moisture content is considered a non-compliant substrate. Action is to be taken to remove liquid water to acceptable levels prior to roofing installation.
- B. Testing Agency: Engage a qualified independent testing agency, acceptable to Architect, to take samples and conduct tests to evaluate insulating concrete.
  - 1. Take samples according to ASTM C 796.
  - 2. Determine as-cast unit weight during each hour of placement, according to ASTM C796.
  - 3. Determine compressive strength according to ASTM C796. Make a set of at least 4 specimens for each 100 cubic yards of material placed, but not less than one set of molds (4) for each day.
- C. Report test results to Architect and insulating concrete producer within 24 hours of completion of each test.
- D. Additional Tests: Make additional tests when test results indicate as-cast unit weight, compressive strength, oven-dry unit weight, or other requirements have not been met.
  - 1. Retest in-place insulating concrete according to ASTM C 513 for compressive strength or with nail withdrawal test, when applicable.
- E. Fastener Pull Testing: Conduct testing in accordance with the Florida Building Code, Dade County, and FM requirements as required for the installation of the modified bituminous roofing system.
  - 1. Provide written report, signed by the roof system manufacturer, before roofing begins.

### 3.4 DEFECTIVE WORK

- A. Refinish, or remove and replace, insulating concrete surfaces that are excessively scaled or too rough to receive roofing, according to current published requirements of roofing manufacturer.
- B. Remove and replace insulating concrete that fails to meet compressive strength and oven-dry unit weight requirements.

END OF SECTION 035216

## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Metal ladders.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Support angles for elevator door sills.
5. Miscellaneous steel trim.

#### 1.2 SUBMITTALS

- A. Product Data: For manufactured items specified.
- B. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.

#### 1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
  2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

#### 1.4 PROJECT CONDITIONS

- A. Field Measurements: Where metal fabrications are indicated to fit walls and other construction, verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

### 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

### 2.3 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.

### 2.4 PAINT

- A. Shop Primer for Ferrous Metal: Refer to Section 099100, Painting.

### 2.5 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Plain Washers: Round, carbon steel, ASME B18.22.1.

- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

## 2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. 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 so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive fasteners and similar items.
- G. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.



- H. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. Fabricate units from structural-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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

## 2.8 MISCELLANEOUS STEEL TRIM

- A. Fabricate units from structural-steel shapes of profiles shown with mitered corners, continuously welded joints, and smooth exposed edges.
- B. Galvanize miscellaneous steel trim at exterior locations.

## 2.9 METAL LADDERS

- A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
  - 1. Comply with ANSI A14.3, unless otherwise indicated.
  - 2. For elevator pit ladders, comply with ASME A17.1.
- B. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: 3/4-inch- diameter steel bars, spaced 12 inches o.c.
- D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and not more than 60 inches on center with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

## 2.10 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.

## 2.11 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. 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.
- C. 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.
- D. 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 so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.

3.3 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.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055000

## SECTION 055113 - METAL PAN STAIRS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Preassembled steel stairs with concrete-filled pans and treads.
2. Handrails and guardrails.

#### 1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal stairs capable of withstanding the following structural loads without exceeding the allowable design working stress of the materials involved, including anchors and connections. Apply each load to produce the maximum stress in each component of metal stairs.

1. Treads and Platforms of Metal Stairs: Capable of withstanding a uniform load of 100 lbf/sq. ft. or a concentrated load of 300 lbf on an area of 4 sq. in., whichever produces the greater stress.
2. Stair Framing: Capable of withstanding stresses resulting from loads specified above in addition to stresses resulting from railing system loads.

B. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding structural loads, in accordance with the Code, without exceeding the allowable design working stress of materials for handrails, railings, anchors, and connections:

1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
  - a. Uniform load of 50 lbf/ft. applied in any direction at the top.
  - b. Concentrated load of 200 lbf applied in any direction at any point along the top.
  - c. Concentrated and uniform loads above need not be assumed to act concurrently.
2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
  - a. Concentrated load of 200 lbf applied at any point and in any direction.
  - b. Uniform load of 50 lbf/ft. applied in any direction.
  - c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Infill Area of Guards:

- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
- b. Infill load and other loads need not be assumed to act concurrently.

1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal stairs. Include plans, elevations, sections, and details of metal stairs and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.
  - 1. Include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
  - 1. Preassembled Stairs: Commercial class.
- B. Fabricator Qualifications: A firm experienced in producing metal stairs similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 STEEL-FRAMED STAIRS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Alfab, Inc.
  - 2. American Stair, Inc.
  - 3. Sharon Companies Ltd. (The).
- B. Stair Framing: Fabricate stringers of structural-steel channels, plates, or a combination of both, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural-steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers; bolt or weld framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
  - 1. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods to support landings from floor construction above. Locate hanger rods within stud space of shaft-wall construction.
- C. Metal Risers, Subtread Pans, and Subplatform Landings: Form to configurations shown from steel sheet of thickness necessary to support indicated loads, but not less than 0.0677 inch.
  - 1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
  - 2. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
  - 3. Shape metal pans to include nosing integral with riser.
  - 4. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

### 2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.

- C. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- D. Uncoated, Cold-Rolled Steel Sheet: Commercial quality, complying with ASTM A 366; or structural quality, complying with ASTM A 611, Grade A, unless another grade is required by design loads.
- E. Uncoated, Hot-Rolled Steel Sheet: Commercial quality, complying with ASTM A 569; or structural quality, complying with ASTM A 570/A 570M, Grade 30, unless another grade is required by design loads.
- F. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

## 2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Sleeve Anchors: Carbon steel anchors complying with FS FF-S-325, Group II, Type 3.
- G. Plain Washers: Round, carbon steel, ASME B18.22.1.
- H. Lock Washers: Helical, spring type, carbon steel, ASME B18.21.1.

## 2.5 PAINT

- A. Shop Primer for Ferrous Metal: Refer to Section 09910, Painting.

## 2.6 CONCRETE FILL AND REINFORCING MATERIALS

- A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, ready-mixed concrete with a minimum 28-day compressive strength of 3000 psi, unless higher strengths are indicated.

## 2.7 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, handrails, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
  - 1. Commercial class, unless otherwise indicated.
- C. Shop Assembly: Preassemble stairs in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Shear and punch metals cleanly and accurately. Remove sharp or rough areas on exposed surfaces.
- E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- F. Weld connections 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. Weld exposed corners and seams continuously, unless otherwise indicated.
  - 5. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

## 2.8 STEEL TUBE HANDRAILS AND RAILINGS

- A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.



- B. Interconnect members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
  - 1. At tee and cross intersections, cope ends of intersecting members to fit contour of tube to which end is joined, and weld all around.
- C. Form changes in direction of handrails and rails as follows:
  - 1. By bending.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of handrail and railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting railings and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
  - 1. Connect railing posts to stair framing by direct welding, unless otherwise indicated.
- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.
- I. For nongalvanized handrails and railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.

## 2.9 FINISHES

- A. Comply with NAAMM'S "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal stairs after assembly.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed products:
  - 1. Interiors (SSPC Zone 1A): SSPC SP 3, "Power Tool Cleaning."

- D. Apply shop primer to prepared surfaces of metal stair components, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
- E. Refer to Section 09 91 00, Painting, for final finish.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete, unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. 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.
- F. 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 so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Place and finish concrete fill for treads and platforms to comply with Division 03 Section "Cast-in-Place Concrete."

### 3.2 INSTALLING RAILINGS

- A. Adjust handrails and railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and railing ends to building construction as follows:
1. Anchor posts to steel by welding directly to steel supporting members.
  2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
  2. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  3. For steel-framed gypsum board assemblies, fasten brackets directly to steel framing or concealed reinforcements using self-tapping screws of size and type required to support structural loads.

### 3.3 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.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 055113

## SECTION 055213 - PIPE AND TUBE RAILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Pipe and tube handrails and railings made of the following:
  - a. Steel pipe and tube railings.

#### 1.2 PERFORMANCE REQUIREMENTS

A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:

1. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."
2. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

B. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding structural loads, in accordance with the Code, without exceeding the allowable design working stress of materials for handrails, railings, anchors, and connections:

1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
  - a. Concentrated load of 200 lbf applied at any point and in any direction.
  - b. Uniform load of 50 lbf/ft. applied horizontally and concurrently with uniform load of 100 lbf/ft. applied vertically downward.
  - c. Concentrated and uniform loads above need not be assumed to act concurrently.
2. Handrails Not Serving as Top Rails: Capable of withstanding the following loads applied as indicated:
  - a. Concentrated load of 200 lbf applied at any point and in any direction.
  - b. Uniform load of 50 lbf/ft. applied in any direction.
  - c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf applied to 1 sq. ft. at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

- a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guards.

- C. NFPA Compliance: Handrails and guardrails shall comply with NFPA 101 Life Safety Code 2000 Edition.

- D. 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 data for prefabricated handrails and railings and accessories.

- B. Shop Drawings: Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.

1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

### 1.4 QUALITY ASSURANCE

- A. Workmanship: The Architect and the Owner are the authority to approve the work and for determining the quality of appearance and standard of high-quality, defect-free work. The Architect and the Owner shall have absolute authority to reject units not meeting their approval.

- B. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

- C. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

### 1.5 STORAGE

- A. Store handrails and railings in a dry, well-ventilated, weathertight place.

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## 1.7 COORDINATION

- A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 METALS

- A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

### 2.2 STEEL

- A. Steel: Provide steel in the form indicated, complying with the following requirements:
  - 1. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:
    - a. Type F, or Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.
  - B. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.
  - C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - D. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

### 2.3 FASTENERS

- A. General: Provide the following:
  - 1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
    - a. Countersink and set fasteners flush with adjacent surfaces where exposed to view.

- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections indicated for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Anchors: Provide chemical anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

## 2.4 WELDING MATERIALS

- A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Shop Primers: Provide primers that comply with Division 9, section Painting.
- 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.

## 2.6 FABRICATION

- A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
  - 1. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
  - 2. Form changes in direction of railing members as follows:
    - a. As detailed.

3. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.
  4. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope components at perpendicular and skew connections to provide close fit, or use fittings designed for this purpose. Weld connections continuously to comply with the following:
    - a. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
    - b. Obtain fusion without undercut or overlap.
    - c. Remove flux immediately.
    - d. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- B. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect handrail and railing members to other work, unless otherwise indicated.
1. Provide inserts and other anchorage devices for connecting handrails and railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by handrails and railings. Coordinate anchorage devices with supporting structure.
- C. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.
- D. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.
- E. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.
- F. Close exposed ends of handrail and railing members with prefabricated end fittings.
- G. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch or less.



- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

## 2.7 STEEL FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings:
  - 1. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."
- B. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
  - 1. Stripe paint edges, corners, crevices, bolts, and welds.
- C. Final Finish: Refer to Section 099100, Painting.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.
  - 1. Do not weld, cut, or abrade surfaces of handrail and 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.
  - 2. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- B. Adjust handrails and railings before anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated, but not less than that required by structural loads.
- C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

### 3.3 ATTACHING HANDRAILS TO WALLS

- A. Secure wall brackets to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in epoxy-type anchors.
  - 2. For hollow masonry anchorage, use toggle bolts.

### 3.4 CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 section Painting.

### 3.5 PROTECTION

- A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion and no sooner. Protective covering shall be removable and replaceable for inspection prior to Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

## SECTION 057300 - DECORATIVE METAL RAILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Decorative metal railings.

#### 1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas, pedestrian guidance and support, visual separation, or wall protection.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.

- B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

- a. Uniform load of 50 lbf/ft. applied in any direction.
- b. Concentrated load of 200 lbf applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
- b. Infill load and other loads need not be assumed to act concurrently.

3. Glass-Supported Railings: Support each section of top rail by a minimum of three glass panels or by other means so top rail will remain in place if any one panel fails.

- C. 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, ambient; 180 deg F, material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of railings assembled from standard components.
  - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.
- D. Samples for Verification: For exposed finish required.
  - 1. Sections of each linear railing members.
  - 2. Welded connections.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

#### 1.7 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

## 1.8 WARRANTY

- A. Exterior Railing Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair the finish or replace metal railings that fail within specified warranty period.
  - 1. Metal Finish: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Aluminum Decorative Railings:
    - a. Architectural Metal Works.
    - b. Superior Aluminum Products, Inc.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

### 2.3 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

- B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221, Alloy 6063-T5/T52.
- C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.
  - 1. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.
- D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.
- E. Plate and Sheet: ASTM B 209.

## 2.4 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Components: Type 316 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated.
- D. Anchors, General: 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.
- E. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 (Type 316) stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.5 MISCELLANEOUS MATERIALS

- A. Wood Rails: Clear, straight-grained hardwood rails secured to metal subrail.
  - 1. Species: Match Architect's sample.
  - 2. Finish: Match Architect's sample.
  - 3. Staining: Match Architect's sample.
  - 4. Profile: As indicated.

- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
  - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- 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. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.

- H. 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.
  - 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 flux immediately.
  - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint.
- I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.
- J. Close exposed ends of hollow railing members with prefabricated end fittings.
- K. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns, unless clearance between end of rail and wall is 1/4 inch or less.
- L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- N. For railing posts set in concrete, provide Type 316 stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.



- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.8 ALUMINUM FINISHES - EXTERIOR

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.9 ALUMINUM FINISHES - INTERIOR

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

## 3.2 INSTALLATION, GENERAL

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. Fit exposed connections together to form tight, hairline joints.
- C. Perform cutting, drilling, and fitting required for installing railings. 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.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- D. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- E. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- F. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

### 3.4 CLEANING

- A. Cleaning: Clean aluminum and stainless steel by washing thoroughly with clean water and soap, rinsing with clean water, and wiping dry.

### 3.5 ADJUSTING AND REPLACEMENT

- A. Touchup Painting: Comply with manufacturer's instructions and recommendations.
- B. Damaged Railings: Repair damaged railings to the satisfaction of the Architect. Replace railings where directed by the Architect.

### 3.6 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057300

## SECTION 057313 - GLAZED DECORATIVE METAL RAILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Post-supported railings with glass infill.

#### 1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

#### 1.3 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of railings assembled from standard components.
  - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, and attachment details.
- C. Samples for Initial Selection: For products involving selection of color, texture, or design.

D. Samples for Verification: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Each type of glass required.
3. Fittings and brackets.
4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

E. 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.

F. Qualification Data: For testing agency.

G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

## 1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on laboratory mockups. Payment for these services will be made by Contractor. Retesting of products that fail to meet specified requirements shall be done at Contractor's expense.

1. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
2. Test railings according to ASTM E 894 and ASTM E 935.
3. Notify Architect seven days in advance of the dates and times when laboratory mockups will be tested.

## 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 DECORATIVE RAILINGS

- A. Product and Manufacturer – Basis of Design: Chesterfield; Sterling Dula Architectural Products, Inc., Erie, PA
  - 1. Railing System: Chesterfield
  - 2. Railing Top Rail; TR-030G
  - 3. Railing Mount: As indicated.
  - 4. Glass Panels: Laminated tinted glass; nominal 3/8-inch thick heat strengthened glass with 0.060 inch thick clear PVB interlayer.
    - a. Glass Color: Match Architect's sample
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior railings by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

- 1. Temperature Change: 120 degrees F, ambient; 180 degrees F, material surfaces.

## 2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

## 2.4 ALUMINUM

- A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
- B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221, 6063-T5 or T6, 6061-T6 or 6005-T5 alloy aluminum.
- C. Plate and Sheet: ASTM B 209.

## 2.5 GLASS AND GLAZING MATERIALS

- A. Safety Glazing: Glazing shall comply with 16 CFR 1201, Category II.
- B. Laminated Glass: ASTM C 1172, Condition A (uncoated), Type I (transparent flat glass), Quality-Q3 with two plies of glass and polyvinyl butyral interlayer not less than 0.060 inch thick.
  - 1. Kind: LHS (laminated heat strengthened).
  - 2. Glass Color: Clear.
  - 3. Interlayer Color: Clear.
  - 4. Glass Thickness: Nominal 3/8-inch.
- C. Safety Glazing Labeling: Permanently mark glass with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

## 2.6 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Components: Type 316 stainless-steel fasteners.
  - 2. Dissimilar Metals: Type 316 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless exposed fasteners are unavoidable.
  - 1. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
  - 1. Material for Exterior Locations: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

## 2.7 MISCELLANEOUS MATERIALS

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- B. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.8 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.



- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- H. Form changes in direction as follows:
  - 1. As detailed.
- I. Close exposed ends of hollow railing members with prefabricated end fittings.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.
- K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

## 2.9 GLAZING PANEL FABRICATION

- A. General: Fabricate to sizes and shapes required; provide for proper edge clearance and bite on glazing panels.
  - 1. Clean-cut or flat-grind edges at butt-glazed sealant joints to produce square edges with slight chamfers at junctions of edges and faces.
  - 2. Grind smooth exposed edges, including those at open joints, to produce square edges with slight chamfers at junctions of edges and faces.
- B. Infill Panels: Provide laminated glass panels.

## 2.10 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.11 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: Match Architect's sample.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. 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.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Manufacturer's standard for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

### 3.3 ANCHORING POSTS

- A. Anchor posts as indicated in accordance with manufacturer's instructions and recommendations.

### 3.4 INSTALLING GLASS PANELS

- A. General: Install assembly to comply with railing manufacturer's written instructions and with requirements. Do not cut, drill, or alter glass panels in field. Protect edges from damage.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to prepare test reports.
- B. Extent and Testing Methodology: Testing agency will randomly select completed railing assemblies for testing that are representative of different railing designs and conditions in the completed Work. Test railings according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.
- C. Remove and replace railings where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and comply with specified requirements.
- D. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

### 3.6 CLEANING

- A. Clean aluminum surfaces in accordance with manufacturer's instructions and recommendations.

- B. Clean and polish glass as recommended in writing by manufacturer. Wash both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion.

### 3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 057313

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Wood nailers and blocking.
3. Wood blocking, cants, and nailers.
4. Plywood backing panels.

#### 1.2 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained, and chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials, both before and after exposure to elevated temperatures when tested according to ASTM D 5516 and ASTM D 5664.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.

#### 1.3 QUALITY ASSURANCE

A. Source Limitations for Fire-Retardant-Treated Wood: Obtain each type of fire-retardant-treated wood product through one source from a single producer.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

### PART 2 - PRODUCTS

#### 2.1 LUMBER, GENERAL

- A. Lumber Standards: Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
  - 1. SPIB - Southern Pine Inspection Bureau.
  - 2. WCLIB - West Coast Lumber Inspection Bureau.
  - 3. WWPA - Western Wood Products Association.
- C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
- D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 1. Provide dressed lumber, S4S, unless otherwise indicated.
  - 2. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.

#### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Pressure Treatment: Wolmanized Natural Select (CBA) preserve pressure treatment; Arch Wood Protection, USA.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in unexcavated areas.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, provide materials that comply with performance requirements in AWPAC C20 (lumber). Identify fire-retardant-treated wood with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according to ASTM D 5664, for lumber.
2. Use treatment that does not promote corrosion of metal fasteners.
3. Use Exterior type for exterior locations and where indicated.
4. Use Interior Type A unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Roof construction.
4. Plywood backing panels.

## 2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Standard, Stud, or No. 3 grade.

1. Application: Interior partitions not indicated as load-bearing.
2. Species: Include but not limited to the following:
  - a. Hem-fir (north); NLGA.
  - b. Mixed southern pine; SPIB.

- c. Spruce-pine-fir; NLGA.
- d. Hem-fir; WCLIB, or WWPA.
- e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

## 2.5 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including but not limited to, the following:
  - 1. Blocking.
  - 2. Cants.
  - 3. Plywood backing panels.
  - 4. Nailers.
  - 5. Furring.
  - 6. Where necessary for installation of other work and not otherwise prohibited.
- B. Fabricate miscellaneous lumber from fire-retardant-treated dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content: 19 percent maximum for lumber items are not specified to receive wood preservative treatment.
- D. Grade: For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No. 3 Common grade per NELMA, NLGA, or WWPA; No. 2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA of any species.

## 2.6 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated.
  - 1. Thickness: 3/4- inch thick.
  - 2. Finish: Fire-retardant paint finish; refer to Division 9 section Painting.

## 2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Where miscellaneous carpentry is in contact with roofing or flashing, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of Type 304 stainless steel.
- B. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.



## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. All rough carpentry related to roofing construction shall be installed in accordance with FM 1-49.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the Building Code.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities.
- H. Discard units of material with defects that impair quality of carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- J. Fit carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- K. Apply field treatment complying with AWPAC M4 to cut surfaces of preservative-treated lumber.
- L. Securely attach carpentry work as indicated and according to applicable codes and recognized standards.
- M. Use fasteners of appropriate type and length. Predrill members when necessary to avoid splitting wood.

### 3.2 WOOD SLEEPERS, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build anchor bolts into masonry during installation of masonry work. Where possible, secure anchor bolts to formwork before concrete placement.

### 3.3 WALL AND PARTITION FRAMING INSTALLATION

- A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.
  - 1. Stud Size and Spacing: As indicated.
- B. Construct corners and intersections with three or more studs, except that two studs may be used for interior non-load-bearing partitions.
- C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
  - 1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

### 3.4 PROTECTION

- A. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

## SECTION 061533 - PATIO DECKING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Patio decking.
  - 2. Railings.

#### 1.2 SUBMITTALS

- A. Product Data: For products indicated.

### PART 2 - PRODUCTS

#### 2.1 DECKING

- A. Product and Manufacturer- Basis of Design: Trex Transcend Decking; Trex Company, Inc.
  - 1. Fire Rating: ASTM E 84 Class B.
  - 2. Decking Colors: To be selected by the Architect from manufacturer's full line.
  - 3. Material Thickness: As indicated.
  - 4. Edge: To be selected by the Architect from manufacturer's full line.

#### 2.2 RAILINGS

- A. Product and Manufacturer- Basis of Design: Trex Transcend Railing; Trex Company, Inc.
  - 1. Railing Colors: To be selected by the Architect from manufacturer's full line.

#### 2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
  - 1. Type 316 stainless steel.

- B. Postinstalled Anchors: Stainless-steel, chemical or torque-controlled expansion anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  - 1. Stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.4 CONCEALED DECKING FASTENERS

- A. Deck Clips: Black-oxide-coated, stainless-steel clips designed to be fastened to deck framing with screws, and to secure decking material with teeth that also provide uniform spacing of decking material.
  - 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. Tiger Claw Inc; Tiger Claw Hidden Deck Fasteners.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
- B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.
- C. Secure decking to framing with deck clips.
- D. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. ICC-ES AC70 for power-driven fasteners.
  - 2. "Fastening Schedule" in ICC's International Building Code.
- E. Railings: Secure wall rails with metal brackets. Fasten freestanding railings to newel posts and to trim at walls with countersunk-head wood screws or rail bolts.

END OF SECTION 061533

## SECTION 061600 - SHEATHING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Exterior gypsum sheathing.

#### 1.2 SUBMITTALS

- A. Comply with pertinent provisions of Section 01 33 00.
- B. Product Data: For products indicated. Indicate component materials and dimensions and include construction and application details.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with manufacturer's instructions and recommendations.
1. Stack panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 SHEATHING

- A. Exterior Gypsum Sheathing: ASTM C 1177, Glass-Mat Gypsum Sheathing Board, with manufacturer's standard edges.
1. Products and Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
    - a. GlasRoc; CertainTeed Corporation
    - b. Dens Glass Sheathing; G-P Gypsum Corporation
    - c. Gold Bond eXP; National Gypsum Company
    - d. Weather Defense Platinum Exterior Sheathing; Lafarge North America
  2. Thickness: 5/8 inch.
  3. Type: Type X, unless otherwise indicated.

## 2.2 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  - 1. Provide fasteners with hot-dip zinc coating complying with ASTM A 153.

## 2.3 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
  - 1. Sheathing Tape: Type recommended by sheathing manufacturer for applications indicated.

## PART 3 - EXECUTION

### 3.1 EXTERIOR GYPSUM SHEATHING INSTALLATION

- A. Comply with manufacturer's written instructions and recommendations.
  - 1. Fasten gypsum sheathing to wood framing with screws.
  - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
  - 4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

END OF SECTION 061600

## SECTION 062023 - INTERIOR FINISH CARPENTRY

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior finish carpentry.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

B. Samples for Verification:

1. For each species and cut of lumber and panel products 50 sq. in. for lumber and 8 by 10 inches for panels.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

- B. Deliver interior finish carpentry materials only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

#### 1.4 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry.

- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 INTERIOR TRIM

- A. Lumber Trim for Opaque Finish (Painted Finish):
  - 1. Profiles: As indicated.
  - 2. Species and Grade: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine; Custom grade; NeLMA, NLGA, or WWPA.
  - 3. Maximum Moisture Content: 13 percent.
  - 4. Finger Jointing: Allowed.
  - 5. Face Surface: Match Architect's samples.

### 2.2 FAUX WOOD BEAMS

- A. Product and Manufacturer – Basis of Design: Model BE-5046-22F Raised Grain Ceiling Beams; Baron Designs, Inc.; [www.fauxwoodbeams.com](http://www.fauxwoodbeams.com)
  - 1. Profiles: As indicated.
  - 2. Color: Walnut.

### 2.3 MISCELLANEOUS MATERIALS

- A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.
- B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.
- C. Multipurpose Construction Adhesive: Formulation complying with ASTM D 3498 that is recommended for indicated use by adhesive manufacturer.



## 2.4 FABRICATION – INTERIOR TRIM

- A. Back out or kerf backs of the following members except those with ends exposed in finished work:
  - 1. Interior standing and running trim except shoe and crown molds.
- B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.
- B. 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. Refinish and seal cuts as recommended by manufacturer.
  - 2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
  - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

### 3.4 STANDING AND RUNNING TRIM INSTALLATION

- A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope or miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
  1. Install trim after gypsum-board joint finishing operations are completed.
  2. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes.

### 3.5 FAUX WOOD BEAMS

- A. General: Install in accordance with manufacturer's instructions and recommendations.

### 3.6 ADJUSTING

- A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

### 3.7 CLEANING

- A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes, if any.

### 3.8 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

## SECTION 064113 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Architectural wood cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing architectural wood cabinets unless concealed within other construction before cabinet installation.
3. Shop finishing of architectural wood cabinets.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural wood cabinets.

C. Samples for Initial Selection:

1. Shop-applied transparent finishes.

D. Samples for Verification:

1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for species and cut, finished on one side and one edge.

#### 1.3 QUALITY ASSURANCE

A. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards".

#### 1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas.

## 1.5 FIELD CONDITIONS

- A. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- B. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood-veneer-faced architectural cabinets can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Wood Products:
  - 1. Hardboard: AHA A135.4.
  - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
  - 3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
  - 4. Softwood Plywood: DOC PS 1.
  - 5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
- B. Grade: Custom.
- C. Type of Construction: As indicated.
- D. Wood for Exposed Surfaces:
  - 1. Species: Match Architect's sample.
  - 2. Cut and Match and Finish: Match Architect's sample.

## 2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hinges:
  - 1. Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
    - a. Item #BH71M2680; Blum distributed by Cabinetparts.com, Inc.
      - 1) Provide minimum 2 hinges per opening; provide additional hinges required based on hinge capacity and weight of door.
- C. Pulls:
  - 1. Product and Manufacturer: Match Architect's samples.
- D. Adjustable Shelf Support Clip:
  - 1. Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
    - a. Item No. 282.47.402 Shelf Support, Double Pin, transparent plastic; Hafele America, Archdale, NC
- E. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
  - 1. Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
    - a. File Drawer Rails: Full extension, side mounted, heavy-duty; 150 pound load rating.
      - 1) Model 4032; Accuride International, Inc.
    - b. All Other Drawers up to 30" Wide: Full extension, side mounted, heavy-duty; 100 pound load rating.
      - 1) Model 4033; Accuride International, Inc.

- c. All Drawers 30" Wide to 42" wide: Full extension, side mounted, heavy-duty; 255 pound load rating.

- 1) Model 7950; Accuride International, Inc.

F. Grommets:

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

- a. Doug Mockett and Co., Inc.

- 1) Color: To be selected by the Architect from manufacturer's full line
    - 2) Type: Plastic with removable cap with slot access.
    - 3) Size: 2.5 inch diameter.

## 2.3 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Do not use adhesives that contain urea formaldehyde.

## 2.4 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.
- B. Wood Cabinets for Transparent Finish:
  - 1. AWI Type of Cabinet Construction: As indicated.
  - 2. Semiexposed Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
  - 3. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
  - 4. Drawer Bottoms: Hardwood plywood.

## 2.5 SHOP FINISHING

- A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Transparent Finish:
  - 1. Grade: Premium.
  - 2. AWI Finish System: Conversion varnish.
  - 3. Finish Color: Match Architect's samples.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

### 3.2 INSTALLATION

- A. General: Install cabinets in accordance with fabricator's instructions and recommendations.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
  - 1. For shop finished items use filler matching finish of items being installed.
- F. 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. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches on center.



- G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064113

## SECTION 064600 - WOOD TRIM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.
3. Shop finishing of wood trim.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

B. Samples for Verification:

1. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with one-half of exposed surface finished.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

#### 1.4 FIELD CONDITIONS

- A. Weather Limitations for Exterior Work: Proceed with installation of exterior wood trim only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.
- B. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim 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.

## 1.5 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 WOOD TRIM, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

### 2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom
- B. Wood Species and Cut: Oak, plain-sawn.
- C. Trim: Refer to the Finish Legend.

### 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content for Interior Materials: 8 to 13 percent.

### 2.4 MISCELLANEOUS MATERIALS

- A. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber , kiln dried to less than 15 percent moisture content.

### 2.5 FABRICATION

- A. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
  - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- B. 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.

- C. Assemble casings in shop except where shipping limitations require field assembly.
- D. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

## 2.6 SHOP PRIMING

- A. Interior Wood Trim for Opaque Finish: Shop prime with one coat of wood primer specified in Section 099100 "Painting."
- B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

## 2.7 SHOP FINISHING

- A. General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.
- C. Opaque Finish for Interior Trim:
  - 1. Color and Sheen: Match Architect's sample.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.
- B. Before installing architectural wood trim, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Grade: Install wood trim to comply with same grade as item to be installed.
- B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
  - 1. For shop-finished items, use filler matching finish of items being installed.
- 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. Do not use pieces less than 36 inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
  - 1. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish.
  - 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
- G. Touch up finishing work specified in this Section after installation of wood trim. Fill nail holes with matching filler where exposed.
  - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are applied in shop.
- H. Refer to Section 099100 "Painting" for final finishing of installed wood trim not indicated to be shop finished.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.

- B. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064600

## SECTION 070150.19 - PREPARATION FOR REROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Full tear-off and re-cover of roof areas indicated.

#### 1.2 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, sections, and details.

C. Temporary Roofing Submittal: Product data and description of temporary roofing system. If temporary roof remains in place, include surface preparation requirements needed to receive permanent roof, and submit a letter from roofing manufacturer, stating acceptance of the temporary roof and that its inclusion does not adversely affect the roofing system's resistance to fire and wind.

D. Qualification Data: For Installer.

1. Include certificate that Installer is approved by warrantor of existing roofing system.
2. Include certificate that Installer is licensed to perform asbestos abatement.

E. Fastener pull-out test report.

F. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by reroofing operations. Submit before Work begins.

#### 1.3 QUALITY ASSURANCE

A. Reroofing Conference: Conduct conference at Project site.

1. Meet with Owner; Architect; Owner's insurer if applicable; testing and inspecting agency representative; roofing system manufacturer's representative; roofing Installer, including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing, including installers of roof deck, roof accessories, and roof-mounted equipment.

2. Review methods and procedures related to roofing system tear-off and replacement, including, but not limited to, the following:
  - a. Reroofing preparation, including roofing system manufacturer's written instructions.
  - b. Temporary protection requirements for existing roofing system components that are to remain.
  - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
  - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.
  - e. Existing roof deck conditions requiring notification of Architect.
  - f. Existing roof deck removal procedures and Owner notifications.
  - g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
  - h. Structural loading limitations of roof deck during reroofing.
  - i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
  - j. HVAC shutdown and sealing of air intakes.
  - k. Existing conditions that may require notification of Architect before proceeding.

#### 1.4 FIELD CONDITIONS

- A. Existing Roofing System: As indicated.
- B. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- D. Conditions existing at time of inspection for bidding are maintained by Owner as far as practical.
- E. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
  1. Remove only as much roofing in one day as can be made watertight in the same day.
- F. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
  1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.



## 1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
  - 1. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

## PART 2 - PRODUCTS

### 2.1 TEMPORARY PROTECTION MATERIALS

- A. Expanded Polystyrene (EPS) Insulation: ASTM C 578.
- B. Plywood: DOC PS1, Grade CD Exposure 1.

### 2.2 TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing are Contractor's responsibilities.
- B. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).
- C. Base Sheet: ASTM D 4601, Type II, nonperforated, asphalt-impregnated and -coated, glass-fiber sheet.
- D. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.
- E. Asphalt Primer: ASTM D 41/D 41M.
- F. Roofing Asphalt: ASTM D 312, Type III or IV.
- G. Base Sheet Fasteners: Capped head, factory-coated steel fasteners, listed in FM Global's "Approval Guide."

### 2.3 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of new roofing system.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Shut off rooftop utilities and service piping before beginning the Work.
- B. Test existing roof drains to verify that they are not blocked or restricted. Immediately notify Architect of any blockages or restrictions.
- C. Protect existing roofing system that is not to be reroofed.
- D. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.
- E. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
  - 1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing roofing system components that are to remain.

### 3.2 ROOF TEAR-OFF

- A. General: Notify Owner each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.
- B. Full Roof Tear-Off: Where indicated, remove existing roofing and other roofing system components down to the deck.
  - 1. Inspect wood blocking, curbs, and nailers for deterioration and damage. If wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
  - 2. Remove fasteners from deck or cut fasteners off slightly above deck surface.

### 3.3 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.
- B. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring **1 pint (0.5 L)** of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.

- C. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect. Do not proceed with installation until directed by Architect.
- D. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.
- E. Provide additional deck securement as indicated on Drawings.
- F. Replace steel deck as directed by Architect. Deck replacement will be paid for by adjusting the Contract Sum according to unit prices included in the Contract Documents.

### 3.4 INFILL MATERIALS INSTALLATION

- A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.
  - 1. Installation of wood blocking, curbs, and nailers is specified in Section 061000 "Rough Carpentry."
- B. Install new roofing patch over roof infill area. If new roofing is installed the same day tear-off is made, roofing patch is not required.

### 3.5 TEMPORARY ROOFING

- A. Install approved temporary roofing over area to be reroofed.

### 3.6 BASE FLASHING REMOVAL

- A. Remove existing base flashings. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.
- B. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings specified in Section 076200 "Sheet Metal Flashing and Trim."
- C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

3.7 DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
  - 1. Storage or sale of demolished items or materials on-site is not permitted.
- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 070150.19

## SECTION 071413 – PLAZA DECK WATERPROOFING AND DECK PAVER SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Plaza deck waterproofing
2. Plaza-deck pavers supported on pedestals.

#### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing and paver system requirements, including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

#### 1.3 SUBMITTALS

A. Product Data: For products indicated. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

B. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins to adjoining waterproofing, and other termination conditions.

1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

C. Samples: For plaza-deck pavers in color required.

D. Qualification Data: For Installer.

E. Field quality-control reports.

F. Sample Warranties: For warranties.

#### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by waterproofing manufacturer.
- B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- C. Protect stored materials from direct sunlight.

## 1.6 FIELD CONDITIONS

- A. Weather Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer.
  - 1. Do not apply waterproofing rain, fog, or mist.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

## 1.7 WARRANTY

- A. Manufacturer's Watertightness Warranty: Manufacturer agrees to repair or replace waterproofing and sheet flashings that do not comply with requirements or that fail to remain watertight within specified warranty period.
  - 1. Warranty includes removing and reinstalling waterproofing materials and pedestal-mounted pavers on plaza decks.
  - 2. Warranty Period: 10 years from date of Substantial Completion.

20 years

## PART 2 - PRODUCTS

### 2.1 PLAZA DECK WATERPROOFING

- A. Waterproofing Membrane:
  - 1. Products and Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ultimate Assembly; American Hydrotech, Inc.
    - b. Notice of Acceptance: Provide current Notice of Acceptance certification.

c. System Components:

- 1) Monolithic Membrane 6125-FR
- 2) Hanover Architectural Pavers on Pedestals

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with waterproofing.
- B. Protection Course: Manufacturer's standard.

2.3 PLAZA-DECK PAVERS

- A. Plaza-Deck Pavers: Heavyweight, hydraulically pressed, concrete units, square edged, manufactured for use as plaza-deck pavers.
  1. Manufacturer:
    - a. Hanover Architectural Products
  2. Color: As selected by Architect from manufacturer's full range.
  3. Size: Manufacturer's standard.
- B. Paver Supports: Paver manufacturer's standard pedestal supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. Verify that concrete has cured and aged for minimum time period recommended by waterproofing manufacturer.
  2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and prepare substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for waterproofing application.

- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.
- D. Remove grease, oil, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
  - 1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate according to ASTM D 4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces according to ASTM D 4258.
- E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, and other voids.

### 3.3 JOINTS, CRACKS, AND TERMINATIONS

- A. Prepare and treat substrates to receive waterproofing membrane, including joints and cracks, deck drains, corners, and penetrations according to manufacturer's written instructions.
- B. At expansion joints and discontinuous deck-to-wall or deck-to-deck joints, bridge joints with elastomeric sheet extended a minimum of 6 inches on each side of joints and adhere to substrates in a layer of hot rubberized asphalt. Apply second layer of hot fluid-applied, rubberized asphalt over elastomeric sheet.

### 3.4 FLASHING INSTALLATION

- A. Install flashing at terminations of waterproofing membrane according to manufacturer's written instructions.

### 3.5 MEMBRANE APPLICATION

- A. Apply material in accordance with manufacturer's instructions and recommendations.
- B. Start application with manufacturer's authorized representative present.
- C. Apply waterproofing over prepared joints and up wall terminations and vertical surfaces to heights indicated or required by manufacturer.



### 3.6 PLAZA-DECK PAVER INSTALLATION

- A. Install concrete pavers according to manufacturer's written instructions.
- B. Accurately install paver pedestals and accessories to elevations required. Adjust for final level and slope with shims.
- C. Install pavers on pedestals. Tightly seat pavers against spacers to eliminate lateral movement or drift of paving assembly. Align joint patterns parallel in each direction.
  - 1. Lay out pavers to avoid less-than-half-width pavers at perimeter or other terminations.
- D. Install pavers to not vary more than 1/16 inch in elevation between adjacent pavers or more than 1/16 inch from surface plane elevation of individual paver.
- E. Limit variation in paving installation to within 1/4 inch in 10 feet of surface plane in any direction; noncumulative.

### 3.7 FIELD QUALITY CONTROL

- A. Engage a full-time site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions; surface preparation; and application of membrane, flashings, protection, and drainage components; furnish daily reports to Architect.
  - 1. Site representative shall measure membrane thickness with pin tester or other suitable device at least once for every 100 sq. ft. and include measurements in reports.
- B. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, waterproofing application, protection, and drainage components, and to furnish reports to Architect.
  - 1. Verify that the structure can support the deadload weight of a watertest before testing.
  - 2. Flood Testing: Flood test each deck area for leaks, according to recommendations in ASTM D 5957, after completing and protecting waterproofing but before overlaying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water. Testing agency shall observe flood testing.
    - a. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of sheet flashings.
    - b. Flood each area for 48 hours.
    - c. After flood testing, repair leaks, repeat flood tests, and make further repairs until waterproofing installation is watertight.

3. Electric Field Vector Mapping (EFVM): Testing agency shall survey entire waterproofing area for potential leaks using EFVM.

### 3.8 CLEANING AND PROTECTION

- A. Protect system from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071413

## SECTION 071416 - COLD FLUID-APPLIED WATERPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fluid applied waterproofing.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

1. Include material descriptions, and tested physical and performance properties of waterproofing.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

#### 1.3 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
- B. Maintain adequate ventilation during application and curing of waterproofing materials.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

#### 2.2 SINGLE-COMPONENT POLYURETHANE WATERPROOFING

- A. Single-Component, Modified Polyurethane Waterproofing: ASTM C 836 and coal-tar free.
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. BASF Construction Chemicals, LLC, Building Systems; Sonoshield HLM 5000.

- b. CETCO; LDC 60.
- c. Tremco Incorporated; Tremproof 201/60.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
  - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Manufacturer's standard primer, sealer, or surface conditioner; factory-formulated acrylic latex, polyurethane, or epoxy.
- C. Sheet Flashing: 50-mil- minimum, nonstaining, uncured sheet neoprene.
  - 1. Adhesive: Manufacturer's recommended contact adhesive.
- D. Membrane-Reinforcing Fabric: Manufacturer's recommended fiberglass mesh or polyester fabric, manufacturer's standard weight.
- E. Joint Reinforcing Strip: Manufacturer's recommended fiberglass mesh or polyester fabric.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
  - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

### 3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

- A. Prepare surfaces at terminations and penetrations through waterproofing according to waterproofing manufacturer's written instructions and to recommendations.

### 3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrate according to waterproofing manufacturer's written instructions and to recommendations. Before coating surfaces, remove dust and dirt from joints and cracks.

### 3.5 WATERPROOFING APPLICATION

- A. Apply waterproofing according to manufacturer's written instructions and to recommendations.
- B. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

### 3.6 PROTECTION

- A. Protect waterproofing from damage during remainder of construction period.
- B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071416

## SECTION 071700 - BENTONITE WATERPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. The following applications of a complete bentonite waterproofing system:
  - a. Bentonite waterproofing.

#### 1.2 SUBMITTALS

- A. Product Data: Include product specifications, installation instructions and recommendations of manufacturer, for each material and type of application required.
- B. Shop Drawings: Show installation details for interface with other work.
- C. Contractor Certificate: Submit written certification that installer has current Approved Applicator status with waterproofing material manufacturer.
- D. Warranty: Submit a specimen of specified waterproofing warranty.
- E. Test Report: Submit manufacturer's test report on water samples taken at the site along with recommendations as a result of these tests.
- F. Field quality-control reports.
- G. Manufacturer Certificates: Signed by materials manufacturer certifying that waterproofing system complies with requirements specified.
- H. Warranty: Sample of special warranty.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Installing company shall have at least three years' experience in work of the type indicated, who can comply with manufacturer's warranty requirements, and who is an Approved Applicator as determined by waterproofing system manufacturer.

- B. Single-Source Responsibility: Obtain bentonite waterproofing system from one source of a single manufacturer. Obtain accessory products used in conjunction with bentonite waterproofing from sources acceptable to the bentonite waterproofing manufacturer.
- C. Preinstallation Conference: Approximately 2 weeks prior to scheduled commencement of waterproofing installation, meet at Project site with Waterproofing Installer; preparer of substrate to receive waterproofing; installers of other work in and around waterproofing that must precede, follow, or penetrate waterproofing (including Mechanical and Electrical Installers as applicable); Architect; Owner; and waterproofing manufacturer's representative to review materials, procedures, schedules, and other requirements and conditions related to installing bentonite waterproofing.
- D. Water Samples: Obtain water samples from the site at approximate locations where waterproofing will be installed and have the waterproofing manufacturer test for acids, alkalis, brine, or other contaminants that may inhibit the performance of untreated bentonite. Comply with manufacturer's recommendations resulting from these tests.
- E. Manufacturer Certificates: Signed by waterproofing system materials manufacturer certifying that the installation complies with requirements specified.
  - 1. Submit evidence of meeting performance requirements.
  - 2. Manufacturer shall attend pre-construction meetings, and shall conduct site visits during construction and after completion of construction (for that phase of work that directly applies to the specific product) before issuing a manufacturer warrantee certificate.
- F. Bentonite installation is to be inspected and approved by the Owner's Authorized Representative.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original unopened containers.
- B. Store materials in a dry, well-ventilated space and in accordance with manufacturer's instructions and recommendations.
- C. Remove and replace bentonite materials that have been prematurely exposed to moisture.

#### 1.5 PROJECT CONDITIONS

- A. General: Comply with manufacturer's recommendations regarding weather conditions before and during installation, condition of the substrate to receive waterproofing, and protection of the installed waterproofing system.

- B. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit bentonite waterproofing to be installed according to manufacturers' written instructions and warranty requirements.
1. Do not apply waterproofing materials to surfaces where ice or frost is visible. Do not apply bentonite waterproofing materials in areas with standing water.
  2. Placing bentonite clay products in panel or composite form on damp surfaces is allowed if approved in writing by manufacturer.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Submit manufacturer's Warranty in which manufacturer agrees to provide waterproofing system materials to repair or replace components of bentonite waterproofing system that fail in materials or workmanship within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.
- B. Installer's Warranty: Submit installer's Warranty in which installer agrees to provide all labor required to repair or replace components of bentonite waterproofing system that fail within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Bentonite Waterproofing – Under Concrete Slabs and Foundations:
1. Product and Manufacturer – Basis of Design: Ultraseal SP; CETCO, Colloid Environmental Technologies Company.
- B. Bentonite Waterproofing – Vertical Walls Below Grade:
1. Product and Manufacturer – Basis of Design: Ultraseal BT; CETCO, Colloid Environmental Technologies Company.

### 2.2 ACCESSORIES

- A. General: Provide accessories as recommended by manufacturer for a complete and waterproof system. Accessories include, but are not limited to, the following:
1. Bentonite Seal (Mastic): Trowelable consistency, bentonite compound, specifically formulated for application at joints and penetrations.
    - a. Product: Bentoseal.



2. Termination Bar: Minimum 1-inch wide aluminum bar with pre-punched holes on 12-inch centering for fastening.
  - a. Fasteners for Termination Bar: 300 Series stainless steel.
3. Seam Tape: Type recommended by the materials manufacturer for applications indicated.
4. Transition Tube: Granular bentonite clay (sodium bentonite), minimum 85 percent montmorillonite (hydrated aluminum silicate), with a minimum of 90 percent passing a 20-mesh sieve.
  - a. Product: Hydrobar Tubes; water-soluble plastic tubing filled with bentonite.
5. Mechanical Fasteners: Case hardened nails or hardened-steel powder-actuated fasteners. Provide 1/2-inch diameter or 1-inch diameter washers (dependant on manufacturer's requirements) under fastener heads.
6. Waterstoppage: Dry granular bentonite.
7. Preformed Waterstop: Flexible strip of bentonite waterproofing compound in cartridge or coil form, designed specifically for vertical and horizontal joints in concrete construction.
  - a. Product: Waterstop Rx.
8. Plastic Sheets: Polyethylene sheeting conforming to ASTM D 4397, thickness as recommended by waterproofing manufacturer to suit application, but not less than 15.0 mils.
9. Sealants: As recommended by manufacturer. Comply with requirements specified in Division 07 Section "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer, manufacturer's representative, and Owner's Representative present, for compliance with requirements for substrate preparations affecting performance of bentonite waterproofing.
- B. Verify that substrate is complete and that work that will penetrate waterproofing is complete and rigidly installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Provide photo documentation.

### 3.2 PREPARATION

- A. General: Comply with manufacturer's instructions and recommendations. Verify that substrate is complete and that all work that will penetrate waterproofing is complete and rigidly installed. Verify locations of waterproofing termination.
  - 1. Coordinate work in vicinity of waterproofing to assure proper conditions for installation of the waterproofing system and to prevent damage to the waterproofing after installation.

### 3.3 INSTALLATION

- A. General: Install waterproofing and accessories according to manufacturer's instructions, standard details, and recommended practices.
  - 1. Protect waterproofing from damage and wetting before and during subsequent construction operations. Repair punctures, tears, and cuts according to manufacturer's written instructions.

### 3.4 FIELD QUALITY CONTROL

- A. Inspection: Arrange for manufacturer's representative and Owner's Representative to inspect during installation and completed waterproofing installation before covering with other construction and provide written report that installation complies with manufacturer's written instructions.
  - 1. Remove and replace applications of bentonite waterproofing where inspection indicates that it does not comply with specified requirements.
  - 2. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.

END OF SECTION 071700

## SECTION 071800 - TRAFFIC COATINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Traffic coatings and pavement markings for the following applications:
  - a. Pedestrian traffic.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated; include installation instructions.

B. Shop Drawings: For traffic coatings.

1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions.
2. Include plans showing layout of pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples for Initial Selection: For exposed finish.

D. Samples for Verification: For exposed finish, prepared on rigid backing.

1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

E. Qualification Data: For Installer.

F. Product Certificates: For each type of traffic coating.

G. Field quality-control reports.

H. Sample Warranty: For special warranty.

I. Maintenance Data: For traffic coatings to include in maintenance manuals.

#### 1.3 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

C. Mockups: Build mockups to set quality standards for materials and execution.

1. Build mockup for each traffic coating and substrate to receive traffic coatings.
2. Size: 200 sq. ft. of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates, when temperatures are below 40 deg F, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
- B. Do not install traffic coating until items that penetrate membrane have been installed.
- C. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature in accordance with material manufacturer's requirements.

1.5 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Adhesive or cohesive failures.
    - b. Abrasion or tearing failures.
    - c. Surface crazing or spalling.
    - d. Intrusion of water into deck substrate.
  2. Warranty Period: Minimum five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Material Compatibility: Provide primers; base-, intermediate-, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Source Limitations:
  - 1. Obtain traffic coatings from single source from single manufacturer.
  - 2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.
  - 3. Obtain pavement-marking paint from single source from single manufacturer.

### 2.2 PEDESTRIAN TRAFFIC COATING

- A. Products and Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Manufacturer: Tremco Incorporated, and RPM Company
    - a. Product: Vulkem 350NF/ 351 System Pedestrian and Waterproofing System
      - 1) Color: As selected by Architect from manufacturer's full range.
      - 2) Total System Thickness: Manufacturer's standard.
      - 3) Aggregate: 2040 Unimin Corp.; seed and lock method.

### 2.3 ACCESSORY MATERIALS

- A. Joint Sealants: Types recommended by the traffic coating manufacturer for applications indicated.
- B. Sheet Flashing: Nonstaining sheet material recommended in writing by traffic-coating manufacturer.
  - 1. Thickness: Manufacturer's standard.
- C. Adhesive: Contact adhesive recommended in writing by traffic-coating manufacturer.
- D. Reinforcing Strip: Fiberglass mesh recommended in writing by traffic-coating manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for surface smoothness, surface moisture, and other conditions affecting performance of traffic-coating work.
- B. Verify that substrates are visibly dry and free of moisture.
  - 1. Test for moisture content by method recommended in writing by traffic-coating manufacturer.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of traffic-coating work.
- D. Proceed with installation only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
  - 1. Begin coating application only after minimum concrete-curing and -drying period recommended in writing by traffic-coating manufacturer has passed and after substrates are dry.
  - 2. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. General: Before applying traffic coatings, clean and prepare substrates according to ASTM C 1127 and manufacturer's written instructions to produce clean, dust-free, dry substrate for traffic-coating application. Remove projections, fill voids, and seal joints if any, as recommended in writing by traffic-coating manufacturer.
- B. Schedule preparation work so dust and other contaminants from process do not fall on wet, newly coated surfaces.
- C. Mask adjoining surfaces not receiving traffic coatings to prevent overspray, spillage, leaking, and migration of coatings. Prevent traffic-coating materials from entering deck substrate penetrations and clogging weep holes and drains.
- D. Concrete Substrates: Mechanically abrade surface to a uniform profile acceptable to manufacturer, according to ASTM D 4259. Do not acid etch.
  - 1. Remove grease, oil, paints, and other penetrating contaminants from concrete.
  - 2. Remove concrete fins, ridges, and other projections.
  - 3. Remove laitance, glaze, efflorescence, curing compounds, concrete hardeners, form-release agents, and other incompatible materials that might affect coating adhesion.
  - 4. Remove remaining loose material to provide a sound surface, and clean surfaces according to ASTM D 4258.

### 3.3 TERMINATIONS AND PENETRATIONS

- A. Prepare vertical and horizontal surfaces at terminations and penetrations through traffic coatings and at expansion joints, drains, and sleeves according to manufacturer's written instructions.
- B. Provide sealant cants at penetrations and at reinforced and nonreinforced, deck-to-wall butt joints.
- C. Terminate edges of deck-to-deck expansion joints with preparatory base-coat strip.
- D. Install sheet flashings at deck-to-wall expansion and dynamic joints, and bond to deck and wall substrates according to manufacturer's written recommendations.

### 3.4 JOINT AND CRACK TREATMENT

- A. Prepare, treat, rout, and fill joints and cracks in substrates according to manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks.
- B. Apply reinforcing strip in traffic-coating system where recommended in writing by traffic-coating manufacturer.

### 3.5 TRAFFIC-COATING APPLICATION

- A. Apply traffic coating according to ASTM C 1127 and manufacturer's written instructions.
- B. Apply number of coats of specified compositions for each type of traffic coating at locations as indicated on Drawings.
- C. Start traffic-coating application in presence of manufacturer's technical representative.
- D. Verify that wet film thickness of each coat complies with requirements every 100 sq. ft..
- E. Uniformly broadcast aggregate on coats specified to receive aggregate. Embed aggregate according to manufacturer's written instructions. After coat dries, sweep away excess aggregate.
- F. Apply traffic coatings to prepared wall terminations and vertical surfaces to height indicated; omit aggregate on vertical surfaces.
- G. Cure traffic coatings. Prevent contamination and damage during application and curing stages.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform the following field tests and inspections:
1. Materials Testing:
    - a. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of Owner and Contractor.
    - b. Testing agency shall perform tests for characteristics specified, using applicable referenced testing procedures.
    - c. Testing agency shall verify thickness of coatings during traffic-coating application for each 600 sq. ft. of installed traffic coating or part thereof.
  2. Electronic Leak-Detection Testing:
    - a. Testing agency shall test each deck area indicated for testing on Drawings for leaks using an electronic leak-detection method that locates discontinuities in the traffic-coating membrane.
    - b. Testing agency shall perform tests on abutting or overlapping smaller areas as necessary to cover entire test area.
    - c. Testing agency shall create a conductive electronic field over the area of traffic coating to be tested and electronically determine locations of discontinuities or leaks, if any, in the traffic coating.
    - d. Testing agency shall provide survey report indicating locations of discontinuities, if any.
  3. If test results show traffic coating does not comply with requirements, remove and replace or repair the membrane as recommended in writing by traffic-coating manufacturer and make further repairs after retesting until traffic-coating installation passes.
- B. Final Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.
1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

### 3.7 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.



- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 071800

## SECTION 072100 - BUILDING INSULATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Insulation.

#### 1.2 SUBMITTALS

- A. Product Data: Each type of insulation product specified.
- B. Product Test Reports: From and based on tests performed by a qualified independent testing agency evidencing compliance of insulation products with specified requirements including those for thermal resistance, fire-test-response characteristics, water absorption, and other properties, based on comprehensive testing of current products.
- C. Research or Evaluation Reports: Reports of the model code organization acceptable to authorities having jurisdiction that evidence compliance of foam-plastic insulations with building code in effect for Project.

#### 1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements indicated without delaying the Work.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated on Drawings or specified elsewhere in this Section as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
1. Surface-Burning Characteristics: ASTM E 84.
  2. Fire-Resistance Ratings: ASTM E 119.
  3. Combustion Characteristics: ASTM E 136.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide insulation products by one of the following:
  - 1. Batt and Sound Attenuation Batt Insulation:
    - a. CertainTeed Corporation.
    - b. Knauf Fiber Glass GmbH.
    - c. Owens-Corning Fiberglas Corporation.
    - d. Schuller International, Inc.
  - 2. Rigid Insulation:
    - a. Atlas Roofing Corporation
    - b. Dow Chemical Company (The)
    - c. Rmax, Inc.

#### 2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
  - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thickness, widths, and lengths.

#### 2.3 BATT INSULATION

- A. Batt Insulation: Unfaced mineral-fiber blanket insulation; ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from glass; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
  - 1. Thickness: As indicated.
  - 2. R-Value: 3.1 per inch thickness, minimum.

## 2.4 SOUND ATTENUATION BLANKET INSULATION

- A. Sound Attenuation Batt Insulation: 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. Thickness: To match cavity space indicated; provide single thickness blanket.

## 2.5 RIGID INSULATION

- A. Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Grade 3 (25 psi), Class A per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

## 2.6 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation, of thickness indicated, securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches in diameter, length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle, capable of holding insulation securely in position indicated with self-locking washer in place, and complying with the following requirements:
1. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
  2. Spindle: Copper-coated low carbon steel, fully annealed, 0.105 inches in diameter, length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
1. Where spindles will be exposed to human contact after installation, protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulation.

### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled
- C. Extend insulation in thickness indicated 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. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

### 3.4 INSTALLATION OF INSULATION

- A. Apply insulation units to substrates, complying with manufacturer's written instructions. Bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Install blanket insulation in cavities formed by framing members according to the following requirements:
  - 1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.
  - 4. Do not force or compact insulation into stud cavity.

- C. Verify that all masonry joints are struck flush and that other conditions are satisfactory for proper installation.
- D. Remove all concrete fins and mortar projections that would interfere with placement of insulation boards.

### 3.5 PROTECTION

- A. General: Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

## SECTION 075216 - MODIFIED BITUMINOUS MEMBRANE ROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Modified bituminous membrane roofing.

#### 1.2 CODE COMPLIANCE

- A. Roofing membrane system shall meet the requirements of the Florida Building Code.
- B. Provide product evaluations and installation requirements indicating compliance.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Install a watertight, modified bituminous membrane roofing and base flashing system with compatible components that will not permit the passage of liquid water and will withstand wind loads, thermally induced movement, and exposure to weather without failure.
- B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.
- C. Roofing System Design: In accordance with the Florida Building Code.
  - 1. Basic Wind Speed: As indicated on the Drawings.
  - 2. Uplift Pressures: As indicated on the Structural Drawings.
- D. FM Listing: Provide modified bituminous membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide". Identify materials with FM markings.
- E. Roofing system shall comply with the following:
  - 1. Fire Classification: Class A.

#### 1.4 SUBMITTALS

- A. Product Approval Certification: Submit current Product Approval certification indicating compliance with the Florida Building Code.

- B. Product Data: Manufacturer's certification label/Florida Building Code compliance, installation instructions, literature and data, and Certificate of Analysis from a testing laboratory for all roof system materials, fastenings, and flashings.
- C. Shop Drawings: For roofing system. Include plans, sections, details, and attachments to other work, include the following:
  - 1. Base flashings, cants, and membrane terminations.
  - 2. Provide wind uplift criteria including wind design engineering calculations and fastener requirements signed and sealed by a Florida certified engineer.
- D. Samples for Verification: For the following.
  - 1. Manufacturer's standard sample size of mineral-granule-surfaced roofing membrane cap sheet and flashing sheet.
  - 2. Manufacturer's standard sample size of walkway pad.
- E. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system and is eligible to receive the standard roofing manufacturer's warranty.
- F. Manufacturer Certificates: Signed by roofing system manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of complying with requirements.
- G. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and owners, and other information specified.
- H. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.
  - 1. Indicate compliance of bulk roofing asphalt materials delivered to Project with requirements. Include quantity and statistical and descriptive data for each product. Submit certificate with each load before it is used.
  - 2. Include continuous log showing time and temperature for each load of bulk bitumen, indicating date obtained from manufacturer, where held, and how transported before final heating and application on roof.
- I. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project from a model code organization acceptable to authorities having jurisdiction.
- J. Maintenance Data: For roofing system to include in the maintenance manuals.
- K. Warranty: Sample copy of roofing manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.



- L. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roof installation.
- M. Meeting Minutes: Submit copies of minutes taken at the preliminary and preapplication roofing conferences.
- N. Fastener Pull Testing Report: Provide signed written report before roofing begins.
  - 1. Provide signed and sealed design calculations.

#### 1.5 QUALITY ASSURANCE

- A. Reference Standard: Comply with the National Roofing Contractor's Association (NRCA), "The NRCA Roofing and Waterproofing Manual" latest edition, "Quality Control Recommendations for Polymer Modified Bitumen Roofing", for application and installation of modified bituminous sheet roofing systems.
- B. 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 warranty.
- C. Manufacturer's Representative: The Representative shall provide Certificates of Compliance for membrane and asphalt compatibility, suitability of inclusion in system and warranty acceptance.
  - 1. At the completion of roofing system installation, the manufacturer's technical representative shall furnish the Owner a letter certifying that the roofing system has been installed in accordance with the manufacturer's instructions and that all provisions have been met for issuance of warranties.
  - 2. Manufacturer will conduct weekly inspection.
- D. Source Limitations: Obtain all components from single source roofing manufacturer.
- E. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 1. Exterior Fire-Test Exposure: Class A; complying with ASTM E 108, for application and slopes indicated.
- F. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the preinstallation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.

- G. Preinstallation Roofing Conference: Approximately 2 weeks prior to scheduled commencement of roofing installation and associated work, meet at Project site with Installer, installer of each component of associated work, installers of deck or substrate construction to receive roofing work, installers of rooftop units and other work in and around roofing that must precede or follow roofing work--including mechanical work, Architect, Owner, roofing system manufacturer's representative, and other representatives directly concerned with work performance, including Owner's insurers, test agencies, and governing authorities, where applicable.
1. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
  2. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and attachment to structural members.
  3. Review loading limitations of deck during and after roofing.
  4. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.
  5. Review governing regulations and requirements for insurance, certifications, and inspection and testing, if applicable.
  6. Review temporary protection requirements for roofing system during and after installation.
  7. Review roof observation and repair procedures after roofing installation.
  8. Record discussions of conference, including decisions and agreements or disagreements reached, and furnish a copy for each attendee. If substantial disagreements exist at the conclusion of the conference, determine how disagreements will be resolved and set a date for reconvening the conference.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.
- B. Store roofing materials in a dry, well ventilated, weather tight location to ensure no significant moisture pickup and maintain at a temperature exceeding roofing system manufacturer's written instructions. Store rolls of felt and other sheet materials on end on pallets or other raised surfaces. Do not double-stack rolls.
1. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.
- C. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

## 1.7 PROJECT CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

## 1.8 WARRANTY

- A. General Warranty: The warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Roofing Manufacturer's Warranty: Provide Johns Manville Peak Advantage No Dollar Limit Roofing System Guarantee; a written warranty, Single-Source, "Wrap-Around", Materials, Labor, and Workmanship Warranty, without monetary limitation (no dollar limit), signed by roofing system manufacturer agreeing to promptly repair leaks in the roof membrane system, including roof membrane, lightweight insulating concrete, sheet metal, and flashing system resulting from defects in materials or workmanship for the following warranty period:
1. Warranty Period: 20 years from date of Substantial Completion.
- C. Installer's Warranty: Provide Installer's warranty, signed by Installer, covering Work of this Section for the following warranty period:
1. Warranty Period: 5 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MODIFIED BITUMINOUS MEMBRANE ROOFING – OVER LIGHTWEIGHT INSULATING CONCRETE

- A. Manufacturer - Basis of Design: Johns Manville Roofing Systems
1. Florida Product Approval No.: 2948-R8; System No. LWC-27
    - a. Description:
      - 1) Base Sheet Ventsulation
      - 2) Fasteners: LWC CR
      - 3) Ply Sheet: Dynaweld Base
      - 4) Membrane: DynaWeld Cap
    - b. Flashing:
      - 1) Ply Sheet: Dynaweld Base
      - 2) Membrane: DynaWeld Cap

## 2.2 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.
- B. Cold-Applied Flashing Adhesive: Roofing system manufacturer's asphalt-based, two-component, asbestos-free, trowel-grade, cold-applied adhesive specially formulated for compatibility and use with flashing applications.
  - 1. Product: MBR Flashing Cement
- C. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing membrane components to substrate, tested by manufacturer for required pullout strength, and provided by the roofing system manufacturer.
- D. Roofing Granules: Ceramic-coated roofing granules, manufacturer's standard.
  - 1. Color: To be selected by the Architect from manufacturer's full line, including White.
- E. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer for intended use.
- F. Liquid Membrane Base Flashing: John Manville liquid membrane flashing system, including base coat, flexible reinforcement, and finish coat.
  - 1. Provide reinforcement as required for a complete flashing system.
  - 2. Apply matching color ceramic granules to match roof membrane sheet.
- G. Walkway Pads: Mineral-granule-surfaced, reinforced modified asphalt composition, slip-resisting pads, manufactured as a traffic pad for foot traffic provided by roofing system manufacturer, with a pad size of 32 inch x 32 inch.
  - 1. Product: DynaTred Plus.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Prior to the commencement of the Work, the construction team shall conduct a visual survey, moisture test, structural survey, and MEP coordination survey.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
  - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.

2. Verify that wood blocking and nailers are securely anchored to roof deck at penetrations and terminations.
  3. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
  4. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Before commencing work, all surfaces shall be smooth, clean, dry and free of any debris that would adversely affect the installation of the membrane.
- B. Before commencing work, the manufacturer's representative, together with the roofing contractor shall inspect and approve the deck condition (slopes and nailing supports if applicable) as well as verticals on parapet walls, roof drains, stack vents, vent outlets and others, building joints, etc. If applicable, a non-compliance notice shall be submitted to the contractor so that adjustments can be made.
1. Commencement of work shall imply acceptance of surfaces and conditions.
- C. Verify that the work of other trades has been properly completed.
- D. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- E. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- F. Do not install materials in conditions of inclement weather.

### 3.3 CONSTRUCTION SEQUENCE

- A. Complete entire roof deck construction before beginning roofing work. Roof shall not be used for subsequent work platform unless properly protected. Phased construction is not permitted.
1. Complete roofing membrane in same day, including base flashing, and stripping except for area where temporary protection is required.
  2. For temporary protection when work is stopped or precipitation is imminent, glaze coat exposed felt surfaces and edges to seal, and install temporary cap flashing over base flashing; anchor securely.
  3. Comply with roof system manufacturer's instructions and recommendations for temporary foot traffic protection.

### 3.4 ROOF INSTALLATION – GENERAL

- A. All roofing systems shall be installed in accordance with manufacturer's instructions and recommendations.
  - 1. Locate drains at points of maximum deflection.
  - 2. Do not use pitch pockets.
  - 3. All wood blocking and cants shall comply with the requirements of the Florida Building Code and compatible with roof materials.
  - 4. Verify surface conditions, roof openings and reglets, substrate conditions and protect adjacent building surfaces.
  - 5. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
  - 6. Remove and discard temporary seals before beginning work on adjoining roofing.
- B. Pitch pans or pitch pockets are not allowed to be used on this Project.
- C. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
- D. Install roofing membrane on clean and dry surfaces, in accordance with the manufacturer's requirements and recommendations and Florida Product Approval certification.
- E. Perform roofing work on a continuous basis as surface and weather conditions allow.
- F. Protect adjoining surfaces against any damage that could result from roofing installation.
- G. Install only as much roofing as can be completed in one day. If weather conditions do not permit such completion, exposed areas shall be temporarily weatherproofed to prevent any water or snow infiltration from damaging other materials already installed.
- H. Maintain all equipment and tools in good working order.

### 3.5 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

- A. Install modified bituminous roofing membrane system according to roofing manufacturer's written instructions. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
  - 1. Adhere to substrate as indicated for system specified.
  - 2. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.
  - 3. Where expansion joints are indicated install in accordance with membrane roofing manufacturer's instructions and recommendations.

- B. Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
  - 1. Repair tears and voids in laps and lapped seams not completely sealed.
  - 2. Apply roofing granules to cover exuded bead at laps while bead is hot.
- C. Install roofing membrane sheets so side and end laps shed water.
- D. At the end of the day's work, and when precipitation is eminent, a water cut-off shall be constructed at all open edges. Construct the cut-off with the same membrane and asphalt. Cut-off must be able to withstand extended periods of wet weather. The water cut-off shall be completely removed prior to resuming the installation of the roofing system.

### 3.6 FLASHING AND STRIPPING INSTALLATION

- A. Install base flashing over cant strips and other sloping and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and recommendations.
- B. Install corner flashing in accordance with roofing system manufacturer's written instructions and recommendations.
- C. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.
- D. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

### 3.7 ROOF DRAINS

- A. Install roof drains in accordance with manufacturer's requirements and recommendations for installations indicated.
- B. Test all drains for proper flow and water tightness. Correct defects.

### 3.8 VENTS (STACKS)

- A. Inspect base ply installation and ensure tight seal around pipe.
- B. Construct and install sheet metal vent sleeve as per details over base ply.
  - 1. Provide a minimum 5-inch base flange.
  - 2. Prime all metal surfaces.
  - 3. Heat metal flange with torch prior to setting in place and firmly pressing on flange to ensure even contact with roof surface.

- C. Heat weld into place a reinforcing sheet of base ply material three feet square over the vent.
  - 1. Seal all seams and edges with a heated trowel.
- D. Install top ply in accordance with membrane roofing system manufacturer's instructions and recommendations.
  - 1. Cut membrane to fit tight against stack sleeve and seal by running a heated trowel around vent base.
- E. Install metal vent cap.

### 3.9 CURBS AND EQUIPMENT SUPPORTS

- A. Inspect and verify that all curbs and equipment supports are properly secured to deck, are level, a minimum 6-inches above finished roof, primed and ready to receive flashings.
- B. Base ply membrane is to run horizontally tight up against the vertical curb or cant as required.
- C. Gusset to be fabricated 4-inch wide by 8-inch long with a 2-inch triangular tip.
  - 1. Install gusset onto corner using a torch and firmly pressing with a hot trowel.
  - 2. Set gusset with triangular tip on base ply and wrapping the corner a minimum 2-inches on each side.
- D. Install base ply flashing in accordance with manufacturer's instructions and recommendations.
  - 1. Pre-cut flashing to the total sum of curb height, thickness plus 1-inch for inside curb securement and 4-inch tie-in along base with width to match that of curb plus 3-inch overlap on each end.
  - 2. Secure along inside of curb with roofing nails.
  - 3. Cut back corner base selvage at 45-degree angle from vertical.
- E. Install top ply in accordance with manufacturer's instructions and recommendations.
  - 1. Pre-cut flashing to the total sum of curb height plus 6-inches for base tie-in with width to match that of curb plus 3-inch overlap at each end.
  - 2. Set granules with heated trowel on all surfaces to receive flashing.
  - 3. Cut flashing flush with the top of curb and seal edges with heated trowel.
  - 4. Cut back corner base selvage at 45-degree angle from vertical.
  - 5. Firmly press flashing into position using a damp sponge.
- F. Provide metal counter flashing.



### 3.10 WALKWAY PAD INSTALLATION

- A. Install walkway pads in accordance with manufacturer's instructions and recommendations.
- B. Install walkway pads in locations indicated on the Drawings.

### 3.11 COPING AND PARAPETS

- A. Verify all surfaces are properly secured and fully primed, ready to receive flashings.
- B. Base ply membrane is to run horizontally tight up to the vertical or cant as required.
- C. Install base ply flashing in accordance with membrane roofing system manufacturer's instructions and recommendations. Carry flashing up the vertical surface, over the top and down the outside face of the parapet a minimum of 3-inches. Fasten along outside edge at 4-inch centers using roofing nails. As an alternate install self-adhering sheet membrane over top of parapet and overlap base flashing.
  - 1. Install a continuous metal cleat (material) and edge as required.
    - a. Prime all dissimilar surfaces prior to membrane or flashing installation.
    - b. Flange on edge to be 4-inch minimum.
    - c. Nail flange to wood blocking at 4-inch center - staggered.
  - 2. Mop top ply membrane and flashing in accordance with membrane roofing system manufacturer's instructions and recommendations.
  - 3. Check base-ply with water hose to confirm no ponding water.

### 3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect and Owner's Authorized Representative.
  - 1. Notify Architect and Owner's Authorized Representative 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will 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 up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.
- D. Remove masking, protection, equipment, materials, and debris from the Work and storage areas, and leave areas in an undamaged and clean condition.
- E. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075216

## SECTION 076200 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Sheet metal flashing and trim in the following categories:
  - a. Copings.
  - b. Metal flashing.
  - c. Self-adhering flashing.
  - d. Formed roof-drainage sheet metal fabrications.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Wind Loads: In accordance with the Florida Building Code.
1. Design Wind Speed: As shown on the Structural documents.
- C. Wind Performance: Copings and edge metal used shall be wind performance tested in accordance with ANSI/SPRI ES-1.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.
- E. Engineering Responsibility: Prepare engineering data for flashing systems, including Shop Drawings, based on testing and engineering analysis of units in assemblies similar to those indicated for this Project as prepared by a professional engineer registered in the state of Florida.
- F. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

### 1.3 SUBMITTALS

- A. Product Data: Include manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
- B. Shop Drawings: Of each item specified showing layout, profiles, methods of joining, and anchorage details.
- C. Certification: Submit test certification stating that copings and edge metal comply with ANSI/SPRI ES-1 to resist design wind loads.
- D. Samples: Of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include Sample sets composed of 2 or more units showing the full range of variations expected.
  - 1. 8-inch- square Samples of specified sheet materials to be exposed as finished surfaces.
  - 2. 12-inch- long Samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.
- E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Owners, and other information specified.

### 1.4 QUALITY ASSURANCE

- A. Quality Control Standard: Sheet Metal & Air Conditioning Contractor's National Association (SMACNA), latest edition, and the Building Code.
- B. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Mockups: Prior to installing sheet metal flashing and trim, construct mockups indicated to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
  - 1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
  - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 4. Construct mockups for the following type of sheet metal flashing:
    - a. Copings.

5. Obtain Architect's approval of mockups before start of final unit of Work.
6. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - a. When directed, demolish and remove mockups from Project site.
  - b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

## 1.5 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

## PART 2 - PRODUCTS

### 2.1 METALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
  1. Factory-Painted Aluminum Sheet: ASTM B 209, 3003-H14, with a minimum thickness of 0.040 inch, unless otherwise indicated.
  2. Extruded Aluminum: ASTM B 221, alloy 6063-T52, with a minimum thickness of 0.080 inch for primary legs of extrusions that are anodized, unless otherwise indicated.

### 2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Underlayment: Butyl based, self-adhering membrane integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 56 mils thick.
  1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
    - a. Grace ; W.R. Grace & Co.
- B. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- C. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."

- D. Self-Adhering Flashing/ Weather Barrier: Butyl based, self-adhering membrane integrally bonded to polyethylene sheeting, formed into uniform flexible sheets of not less than 40 mils thick.
- E. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

## 2.3 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- E. Expansion Provisions: Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Separate metal from noncompatible metal or corrosive substrates with self-adhering flashing material.
- H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
  - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

## 2.4 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12 foot long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings. Form with 2-inch- high end dams. Fabricate from the following material:
1. Stainless Steel: Minimum 0.0156 inch thick.

## 2.5 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:
1. Aluminum: 0.050 inch thick, minimum.
- C. Copings: Fabricate from the following material:
1. Aluminum: 0.050 inch thick, minimum.
- D. Base Flashing: Fabricate from the following material:
1. Aluminum: 0.040 inch thick, minimum.
- E. Equipment Support Flashing: Fabricate from the following material:
1. Aluminum: 0.040 inch thick, minimum.

## 2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
1. Gutter Size and Profile: As indicated.
  2. Gutters with Girth up to 20 Inches: Fabricate from the following materials:
    - a. Aluminum: 0.040 inches thick.

3. Gutters with Girth 21 to 25 Inches: Fabricate from the following materials:
  - a. Aluminum: 0.050 inches thick.
4. Accessories: Wire-ball downspout strainer.
- B. Downspouts: Fabricate downspouts to profiles and dimensions indicated, complete with mitered elbows. Furnish with metal hangers. Shop fabricate elbows.
  1. Hanger Style: As indicated.
  2. Fabricate from the following materials:
    - a. Aluminum: 0.040 inches thick.
- C. Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:
  1. Aluminum: 0.032 inch thick.
- D. Collector Boxes: Fabricate boxes with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim,. Fabricate from the following materials:
  1. Aluminum: 0.032 inch thick.

## 2.7 ALUMINUM FINISHES

- A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.
- B. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  1. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2604.
    - a. Color: Custom to match Architect's samples.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.
  - 1. Install exposed sheet metal Work that is without oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- B. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- C. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
  - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
- D. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- E. Separations: Separate metal from noncompatible metal or corrosive substrates using self-adhering flashing material.
- F. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant.

- G. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Seal flashing to equipment support member.

### 3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
- B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
1. Fasten gutter spacers to front and back of gutter.
  2. Install gutter with expansion joints not exceeding, 50 feet apart. Install expansion-joint caps.
  3. Install continuous gutter screens on gutters with noncorrosive fasteners, hinged to swing open for cleaning gutters.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c.
- D. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
1. Anchor scupper closure trim flange to exterior wall.
  2. Loosely lock front edge of scupper with conductor head.
  3. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.
- E. Collection Boxes: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.
- F. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints minimum of 4 inches in direction of water flow.

### 3.4 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 076200

## SECTION 078100 - APPLIED FIREPROOFING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Spray applied fireproofing; interior/concealed sprayed fire-resistive materials (SFRM).

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

B. Shop Drawings: Framing plans, schedules, or both indicating the following:

1. Locations and types of surface preparations required before applying SFRM.
2. Extent of fireproofing for each construction and fire-resistance rating.
3. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
4. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

C. Qualification Data: For Installer and testing agency.

D. Product Certificates: For fireproofing.

E. Evaluation Reports: For fireproofing.

F. Preconstruction Test Reports: For fireproofing.

G. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:

1. Materials have been tested for bond with substrates.
2. Materials have been verified by SFRM manufacturer to be compatible with substrate primers and coatings.
3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fireproofing.

I. Field Quality-Control Test Reports: Submit completed reports.

J. Preinstallation Meeting Reports: Submit meeting minutes.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Source Limitations: Obtain SFRM through one source from a single manufacturer.
- C. Preinstallation Meeting: Conduct conference at Project site. Review methods and procedures related to SFRM including, but not limited to, the following:
  - 1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.
  - 2. Review and finalize construction schedule and verify sequencing and coordination requirements.
  - 3. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
  - 4. Review surface conditions and preparations.
  - 5. Review field quality-control testing procedures.

### 1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on fireproofing.
  - 1. Provide test specimens and assemblies representative of proposed materials and construction.
- B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
  - 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E 736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
  - 2. Density: Test for density according to ASTM E 605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
  - 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with fireproofing.
  - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 5. For materials failing tests, obtain applied-fireproofing manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
- B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
- C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

## 1.7 COORDINATION

- A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:
  - 1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
  - 2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
  - 3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
  - 4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
  - 5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
  - 6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
  - 7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.

8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. Asbestos: Provide products containing no detectable asbestos.

### 2.2 SPRAY APPLIED FIREPROOFING - INTERIOR/CONCEALED SPRAYED FIRE-RESISTIVE MATERIALS

- A. Products and Manufacturers: Provide one of the following:
  1. Product and Manufacturer – Basis of Design: MK-6/HY; W.R. Grace & Co.
    - a. Binder Type: Gypsum.
    - b. Air Erosion: 0.000 g/m<sup>2</sup> (.000 g/ft<sup>2</sup>) ASTM E 859
    - c. Corrosion: Does not contribute to corrosion of steel. ASTM E 937
  2. Pyrolite 15; Carbolite Co., Fireproofing Products Div.
    - a. Binder Type: Gypsum.
    - b. Air Erosion: 0.000 g/m<sup>2</sup> (.000 g/ft<sup>2</sup>) ASTM E 859
    - c. Corrosion: Does not contribute to corrosion of steel. ASTM E 937

### 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design. Verify compliance with the following:
  - 1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
  - 2. Objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
  - 3. Substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Conduct tests according to fireproofing manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Application of the fireproofing shall not begin until the contractor, applicator and fireproofing testing laboratory (inspector) have examined surfaces to receive fireproofing and determined that the surfaces are acceptable to receive the fireproofing material.

### 3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.



### 3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
  - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
  - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written recommendations for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- E. Spray apply fireproofing to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.

### 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
  - 1. Test and inspect as required by the IBC and authorities having jurisdiction.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

- C. Fireproofing will be considered defective if it does not pass tests and inspections.
  - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
  - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

### 3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing will be without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF DOCUMENT 078100

## SECTION 078413 - PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:
  - a. Walls and partitions.
  - b. Floors, ceilings, and roofs.
  - c. Smoke barriers.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: For the following constructions, provide through-penetration firestop 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 penetrated.
  1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
  2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
- B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.
  1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
  2. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

### 1.3 SUBMITTALS

- A. Product Data: For each type of through-penetration firestop system product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
  - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
  - 2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and Owners, and other information specified.
- D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed through-penetration firestop systems similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Installer Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:
1. Firestopping 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 firestop systems acceptable to authorities having jurisdiction.
  2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:
    - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
      - 1) UL in "Fire Resistance Directory."
- E. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

## 1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hilti Construction Chemicals, Inc.
  - 2. Nelson Firestop Products.
  - 3. 3M Fire Protection Products.
  - 4. Tremco

### 2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
  - 1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-/rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.

- c. Fire-rated form board.
- d. Fillers for sealants.
- 2. Temporary forming materials.
- 3. Substrate primers.
- 4. Collars.
- 5. Steel sleeves.

## 2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated by reference to the types of materials described in this Article. Fill materials are those referred to in directories of the referenced testing and inspecting agencies as fill, void, or cavity materials.
- B. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged, dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable, heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
  1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
  2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.



### 3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 FIELD QUALITY CONTROL

- A. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

### 3.5 IDENTIFICATION

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - 1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Through-penetration firestop system manufacturer's name.
  - 6. Installer's name.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 078413

## SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Fire-resistive joint systems for the following:
  - a. Floor-to-floor joints.
  - b. Floor-to-wall joints.
  - c. Head-of-wall joints.
  - d. Wall-to-wall joints.
  - e. Joints between perimeter edge of fire-resistance-rated floor assemblies and back of non-fire-resistance-rated, exterior, glazed aluminum curtain walls.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: For joints in the following constructions, 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:
1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
  2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
  3. Fire-resistance-rated floor assemblies.
  4. Exterior curtain-wall assemblies and fire-resistance-rated floor assemblies.
- B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.
1. Load-bearing capabilities as determined by evaluation during the time test.
- C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by UBC Standard 26-9 and UL 2079.

#### 1.3 SUBMITTALS

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

- B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed and relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
  - 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.
- C. Research/Evaluation Reports: For each type of fire-resistive joint system.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire-resistive joint systems for each kind of joint and construction condition indicated through one source from a single manufacturer.
- B. Preconstruction Compatibility and Adhesion Testing: Submit to fire-resistive joint system manufacturers, for testing indicated below, samples of materials that will contact or affect fill materials.
  - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of fill materials to joint substrates.
    - a. Perform tests under environmental conditions replicating those that will exist during installation.
  - 2. Submit no fewer than nine pieces of each type of material, including joint substrates, forming materials, and miscellaneous materials.
  - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 4. For materials failing tests, obtain fire-resistive joint system manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
- C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in "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 UL 2079. Provide rated systems complying with the following requirements:
  - 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 listed by the following:
    - 1) UL in its "Fire Resistance Directory."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

#### 1.7 COORDINATION

- A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.
- B. Coordinate sizing of joints to accommodate fire-resistive joint systems.
- C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
1. Fire-Resistive Joint Systems:
    - a. A/D Fire Protection Systems Inc.
    - b. DAP Inc.
    - c. Firestop Systems Inc.
    - d. Hilti, Inc.
    - e. ISOLATEK International.
    - f. Nelson Firestop Products.
    - g. 3M Fire Protection Products.
    - h. Tremco, Inc.
  2. Perimeter Fire-Containment Systems:
    - a. Specified Technologies Inc.
    - b. United States Gypsum Company.

### 2.2 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL

- 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 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.

### 2.3 FIRE-RESISTIVE JOINT SYSTEMS

- A. Where UL-classified fire-resistive joint systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHBN.

### 2.4 PERIMETER FIRE-CONTAINMENT SYSTEMS

- A. Where UL-classified perimeter fire-containment systems are indicated, they refer to alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHDG.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
  - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

### 3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.
- B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

- C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
  - 2. Apply fill materials so they contact and adhere to substrates formed by joints.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

#### 3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistive joint systems and to prepare inspection reports.
  - 1. Inspecting agency will state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.
- B. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistive joint systems.
- C. If deficiencies are found, repair or replace fire-resistive joint systems so they comply with requirements.

#### 3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078446



## SECTION 079200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Sealants for interior and exterior applications.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

#### 1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
- D. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.
- E. Field Test Report Log: For each elastomeric sealant application. Include information specified in "Field Quality Control" Article.
- F. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

- G. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.
- H. Warranties: Special warranties specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Manufacturer's Representative: Manufacturer's representative shall certify the installation of sealant materials and shall attend pre-construction meetings, make site visits during construction and after completion of each phase of work that directly applies to the materials being installed before issuing a warrantee certification.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of each type of sealant and backing installation; minimum length 8 feet.
  - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.

2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degrees F.
  3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

## 1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric 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: As specified beginning from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Provide the following products for each application listed. Substitutions for exterior building joint sealants shall be listed on the Validated Products list published by the Sealant, Waterproofing, and Restoration Institute (SWRI).
1. Joint-Sealant: One-part neutral cure silicone sealant; elongation of 800%, joint movement capability of plus-or-minus 25% and Shore A durometer hardness of 45.
    - a. Applications: Interior air sealing between a sheet or liquid applied weather resistant barrier and fenestration element; edge lap seal for weather resistant barriers; sealing penetrations in weather resistant barriers.

- b. Joint Location: Surfaces common in sheet or peel and stick weather resistant barriers.
  - 1) Product and Manufacturer: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a) Dow Corning 758 Silicone Weather Barrier Sealant; Dow Corning Corp.
- 2. Joint Sealant - One-Part: For precast concrete, poured-in-place concrete, and concrete-to-concrete and concrete-to-masonry; one-part silicone sealant, having a joint movement capability of plus-or-minus 100% elongation, minus 50% compression, and Shore A durometer hardness of 15.
  - a. Product and Manufacturer:
    - 1) Dow Corning 790 Silicone Building Sealant; Dow Corning Corp.
  - b. Warranty: Manufacturer's standard 20-year warranty.
- 3. Joint Sealant - One-Part: For masonry-to-aluminum, steel-to-aluminum, concrete-to-aluminum, steel-to-steel, and other metal-to-metal joints (including KYNAR coatings); one-part silicone sealant having a joint movement capability of plus-or-minus 50% elongation, and Shore A durometer hardness of 30.
  - a. Product and Manufacturer:
    - 1) Dow Corning 795 Silicone Building Sealant; Dow Corning Corp.
  - b. Warranty: Manufacturer's extended 20-year warranty.
- 4. Joint Sealant - Two-Part, Pourable Urethane Sealant: For horizontal joints, exterior and interior; provide joint sealant with a joint movement capability of plus-or-minus 25%.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) Vulkem 245; Tremco, Inc.
    - 2) NR200 Urexpan; Pecora Corp.
    - 3) Sikaflex 2c SL; Sika Corp.
    - 4) THC-900; Tremco, Inc.
  - b. Warranty: Manufacturer's extended 5-year warranty.
- 5. Joint Sealant - Two-Part Urethane Non-Sag Sealant: For general interior use; provide joint sealant with a joint movement capability of plus-or-minus 50%.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) Vulkem 922; Tremco, Inc.

- 2) Dynatrol II; Pecora Corp.
  - 3) Sikaflex 2c NS; Sika Corp.
  - 4) NP II; Sonneborne Building Products Division, ChemRex, Inc.
- b. Warranty: Manufacturer's extended 5-year warranty.
6. Joint Sealant - One-Part Silicone - Sanitary Sealant: For Interior use at plumbing fixtures in toilets and janitor closets, and horizontal and vertical joints of dissimilar materials in toilets and other wet areas.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) Dow Corning 786 Silicone Mildew Resistant Sealant; Dow Corning Corp.
    - 2) SCS1700 Sanitary; General Electric Co.
    - 3) Pecora 898 Silicone Mildew Resistant Silicone Sealant; Pecora Corp.
    - 4) Tremsil 200; Tremco, Inc.
  - b. Warranty: Manufacturer's extended 3-year warranty.
7. Joint Sealant - One-Part Latex Sealant: For interior use for horizontal and vertical joints around door frames, and joints between dissimilar materials.
  - a. Products and Manufacturers: Provide one of the following.
    - 1) AC-20 + Silicone; Pecora Corp.
    - 2) Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
    - 3) Tremflex 834; Tremco, Inc.
  - b. Warranty: Manufacturer's standard warranty.
8. Joint Sealant - Exterior Joints Below Grade: Polyurethane (contrasting color).
  - a. Product and Manufacturer: Provide the following.
    - 1) Cecoflex 1-A
9. Joint Sealant - Acoustic 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.
  - a. Product and Manufacturer: Provide the following.
    - 1) Pecora Corporation; AC-20 FTR.
    - 2) USG Corporation; SHEETROCK Acoustical Sealant.

## 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

## 2.3 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Backer Rod (Joint Fillers, Compressible Filler): Type B, ASTM C 1330, preformed, cylindrical, flexible, compressible, resilient, non-staining, bi-cellular material, with a density of 24-48 km/m3 per ASTM D1622, tensile strength greater than 200 kPa per ASTM D 1623, and water absorption less than 0.1 g/cc per ASTM C 1016.
  - 1. Product and Manufacturer - Basis of Design:
    - a. Sof Rod; Nomaco, Inc., Zebulon, NC.
  - 2. Other Acceptable Manufacturers: Manufacturers offering products having performance characteristics meeting or exceeding those specified may be incorporated into the Work.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.4 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, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Verify location and application of acoustical sealant and all other sealants indicated. Do not allow sealants to come into contact with incompatible materials. Prevent reaction to metals and other substances; protect all surfaces.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates, unless otherwise recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience.
  - 1. 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 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.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
  - 1. Install sealants by proven techniques and at the same time backings are installed.
  - 2. Place sealants so they directly contact and fully wet joint substrates.
  - 3. Completely fill recesses provided for each joint configuration.
  - 4. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- B. Backing Materials: Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of 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. Bond-Breaker Tape: Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- D. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Perform field-test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
    - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
  2. Test Method: Test joint sealants by hand-pull method described below:
    - a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches long at sides of joint and meeting cross cut at one end. Place a mark 1 inch from crosscut end of 2-inch piece.
    - b. Use fingers to grasp 2-inch piece of sealant between cross-cut end and 1-inch mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
    - c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.



3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
  4. Inspect tested joints and report on the following:
    - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.
    - b. Whether sealants filled joint cavities and are free from voids.
    - c. Whether sealant dimensions and configurations comply with specified requirements.
  5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
  6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.
- B. Evaluation of Field-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.

### 3.5 CLEANING

- A. Clean off excess sealants 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.

### 3.6 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 079200

## SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Steel doors.
  - 2. Steel door frames.
  - 3. Fire-rated door and frame assemblies.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. General: Provide exterior steel doors and frames capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified.
- B. Codes Compliance: Comply with requirements of the Florida Building Code for wind and impact resistance.
- C. Wind Loads: As indicated on Drawings.

#### 1.3 DEFINITIONS

- A. Steel Sheet Thickness: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

#### 1.4 SUBMITTALS

- A. Product Approval: Submit current Product Approval in accordance with the Florida Building Code for the following:
  - 1. Exterior steel doors and frames.
- B. Engineering Responsibility: Prepare engineering data for exterior steel doors and frames including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project signed and sealed by a professional engineer registered in the state of Florida.
- C. Testing and Labeling: Comply with the Florida Building Code. Submit manufacturer's certification indicating compliance.

- D. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- E. Certification: Provide written certification indicating Code compliance for all exterior doors and frames.
- F. Shop Drawings: SDI-106 Recommended Standard Door Type Nomenclature and SD-111 Recommended Standard Details for Steel Doors & Frames shall be used as a guide in the development of Schedules and Shop Drawings.
  - 1. Show the following:
    - a. Elevations of each door design.
    - b. Indicate location, size, door and frame types, rating and hand of each door.
    - c. Indicate door construction, details and methods of assembling sections, hardware locations, anchorage & fastening methods and finish requirements.
    - d. Coordination of glazing frames and stops with glass and glazing requirements.
    - e. Include anchoring details engineered to meet wind load requirements to comply with the Code.
    - f. Utilize same designation as Architect's door mark.
- G. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.
- H. Samples:
  - 1. Submit sample of typical mitered, welded doorframe corner for quality verification.
  - 2. Samples shall be specifically required for non-specified manufacturer's products submitted as a Substitution.
- I. Product Certificates: Product certificates shall be required by manufacturers of non-named products certifying that each product furnished meets the Specifications and with individual project requirements for the purpose intended. Certificates shall be submitted with Shop Drawings.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Employ only experienced Contractors (Installers) skilled in the successful installation of the specified materials and assemblies on similar projects for a minimum of five years.

- B. **Supplier Qualifications:** Supplier shall be regularly engaged in contract work and be staffed to expedite the work. The firm shall have been furnishing material for projects of similar scope, in the vicinity, for not less than 5 years. At the Owner's request the supplier shall send qualified representatives to the job site when needed during the course of installation. The supplier shall be or shall employ a Certified Door Consultant (CDC), certified by DHI, who shall be available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- C. **Source Limitations:** Obtain steel doors and frames through one source from a single manufacturer.
- D. **Steel Door and Frame Standard:** Comply with requirements contained in SDI 100 Recommended Specifications for Standard Steel Doors and Frames unless more stringent requirements are indicated.
- E. **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 or UL 10C.
- F. **Preparation/Field Verification**
  - 1. Verify doorframes are in proper location and have been properly anchored in accordance with Specifications and SDI 105 Recommended Erection Instruction for Steel Frames.
  - 2. Verify that frames comply with indicated requirements for type, size, location and swing characteristics. Verify that frames have been installed with plumb jambs and level heads.
  - 3. Verify that Shop Drawings have been successfully submitted, reviewed and returned.
- G. **Frame Tolerances:** Utilize UNF Frame Tolerance Check List Report for each opening to verify proper installation.
  - 1. Initiate reports after installation of frame and prior to installation of adjacent walls or construction. Re-verify report during and after completion of adjacent construction.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage.
- B. Doors shall be individually wrapped, protected and packaged as standard of manufacturer.
- C. Each door shall be marked on top and bottom rail with same opening number used on Shop Drawings.

- D. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- E. Store doors and frames at building site under cover. Place units on minimum 4-inch-high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

## 1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Steel Doors and Frames:
    - a. Amweld Building Products, Inc.
    - b. Ceco Door Products
    - c. Curries Company
    - d. Steelcraft

### 2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

- B. Cold-Rolled Steel Sheets: ASTM A 366, Commercial Steel (CS), or ASTM A 620, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.
- C. Metallic-Coated Steel Sheets: ASTM A 653, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

## 2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
  - 1. Design: As indicated.
  - 2. Thickness: As indicated.
  - 3. Core Construction: Manufacturer's standard foamed-in-place polyurethane core that produces doors complying with ANSI A250.8.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    - b. Insulated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
      - 1) Locations: Non-fire rated doors, exterior and interior.
  - 4. Vertical Edges for Single-Acting Doors: Beveled edge.
    - a. Beveled Edge: 1/8 inch in 2 inches.
  - 5. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
  - 6. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick end closures or channels of same material as face sheets.
  - 7. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

## 2.4 EXTERIOR DOORS

### A. Exterior Flush Steel Doors and Frames Requiring Florida Product Approval:

1. Product and Manufacturer – Basis of Design: Steelcraft Steel Doors; Ingersoll-rand
  - a. Notice of Acceptance Number:
    - 1) Single Doors: 12-0305.16
      - a) Expiration Date: May 05, 2015
    - 2) Double Doors: 12-0305.15
      - a) Expiration Date: May 05, 2015

### B. Exterior Service and Maintenance Doors not Requiring Product Approval: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Minimum SDI Level and Physical Performance: Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).

## 2.5 INTERIOR DOORS

### A. General: Provide doors of sizes, thickness, and designs indicated.

### B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Minimum SDI Level and Physical Performance: Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

## 2.6 FRAMES

### A. General: ANSI A250.8 and with details indicated for type and profile.

1. Frame Gauge: 16 gauge minimum for all door frames.

## 2.7 ACCESSORIES

### A. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

- B. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.
  - 1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.
- C. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.
- D. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- E. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.
- F. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.
- G. Bituminous Coating: Cold-applied asphalt mastic, two coats minimum 30-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.8 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
  - 1. Face sheets shall be minimum 16 gauge (0.053 in) hot-dipped galvanized steel sheets conforming to ASTM A591, Commercial Steel (CS) Class B coating, mill phosphatized.
- C. Interior Door Faces: Fabricate exposed faces of doors, including stiles and rails of nonflush units, from the following material:
  - 1. Face sheets shall be minimum 18 gauge (0.042 in) cold-rolled steel sheets conforming to ASTM A366/A 366M, Commercial Steel (CS) or ASTM A620/A 620M, Drawing Steel (DS), Type B.



- D. Core Construction: Manufacturer's factory installed core materials that produce a door complying with SDI standards:
1. Exterior Doors: Insulated; polyurethane or polystyrene core.
  2. Interior Non-Fire Rated Doors: Insulated; polyurethane or polystyrene core.
  3. Interior Fire Rated Doors: Manufacturer's standard core for fire ratings indicated.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jams and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.
- G. Single Acting, Door-Edge Profile: Beveled edge.
- H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- K. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
- L. Frame Construction: Fabricate frames to shape shown.
1. Frames shall be welded construction type and have mitered or butted corners with welded and finished frame faces (seamless). The remaining elements of the frame profile, i.e., rabbet and stop, shall not be continuously welded.
  2. Frames for exterior use shall have mitered corners welded continuously and finished frame faces (seamless).
  3. Frames shall be provided with temporary spreader bars for shipping and handling purposes.
  4. Frames for exterior use shall be hot-dipped galvanized steel after fabrication.
  5. Frames for paired doors shall be furnished with a removable center mullion, where indicated.
  6. Mullions and transom bars shall be joined to adjacent members by welding so as to maintain alignment of parts and assure performance of completed frames. Face joints shall be welded and ground smooth (seamless).
  7. Exterior frames shall be anchored in accordance with the Notice of Acceptance.
  8. Interior frames shall be provided with a minimum of three anchors per jamb suitable for the adjoining wall construction. Anchors shall be minimum 18-gauge steel or minimum 7-gauge wire. Frames over 7'-6" shall be provided with additional wall anchors as required.

9. In addition, frames shall be provided with minimum 18-gauge base anchor. For existing masonry wall conditions that will not accept base anchor, an additional jamb anchor shall be provided.
10. Frames shall be furnished in manufacturer's standard factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

M. Hardware Preparation

1. Provide minimum hardware reinforcing gauges as required in ANSI A250.6.
2. Doors and frames shall be reinforced, drilled and tapped to receive mortised hinges, locks, latches, flush bolts, etc, as required in ANSI A115 and ANSI A250.6.
3. Doors shall be reinforced for specified surface-mounted hardware. Drilling and tapping may be completed at the job site by the installers.
4. Hardware shall be located in accordance with locations prescribed in ANSI A250.8/SDI 100.

N. Fire-Rated Doors, Frames, Hardware and Components:

1. Both fire-rated doors and frames shall bear labels of a recognized test lab or certifying agency acceptable to the authority having jurisdiction. Door labels shall indicate the hourly rating; frame labels do not indicate the hourly rating since they assume the rating of the fire door.

2.9 FINISHES

- A. Factory Finish: Factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
  1. Coat all surfaces including tops and bottoms of doors.
- B. Field Finishing:
  1. Doors and Frames: Refer to Section 09912, Painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that will be filled with grout.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled 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. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
  - 7. 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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  - 3. Smoke-Control Doors: Install doors according to NFPA 105.

- D. Glazing: Comply with installation requirements in Division 8 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 on center and not more than 2 inches on center from each corner.

### 3.4 PROTECTION DURING CONSTRUCTION

- A. Steel doors shall be protected at all times during construction. After installation, take appropriate measures to protect doors from abuse.
- B. Replace doors and frames that are damaged or do not comply with requirements. Doors and frames may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

### 3.5 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

## SECTION 081416 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors with veneer faces.
  - 2. Factory machining for hardware.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of door and pocket door frame. Include details of core and edge construction, and trim for openings. Include factory-finishing specifications.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Mark each door on top and bottom rail with opening number used on Shop Drawings.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist), or show telegraphing of core construction in face veneers.
  - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

2. Warranty shall be in effect during the following period of time from date of Certificate of Occupancy.
  - a. Solid-Core Interior Doors: Manufacturer's standard warranty.

## PART 2 - PRODUCTS

### 2.1 SOLID-CORE WOOD DOORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Flush Wood Doors:
    - a. Algoma Hardwoods Inc.
    - b. Eggers Industries; Architectural Door Division.
    - c. Marshfield DoorSystems, Inc.
    - d. VT Industries, Inc.

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Urea-Formaldehyde: Wood materials shall contain no added urea-formaldehyde.

### 2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Algoma Hardwoods, Inc.
    - b. Eggers Industries.
    - c. Marshfield DoorSystems, Inc.
  2. Grade: Premium.
  3. Finish: Match Architect's samples.
  4. Wood Species and Cut: Match Architect's sample.
  5. Construction: Five plies. Stiles and rails bonded to core; entire unit abrasive planed before veneering.

## 2.4 LIGHT FRAMES

- A. Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.0478-inch-thick, cold-rolled steel sheet; factory primed.
  - 1. Jamb: Split jamb with zinc coated steel sides and back.

## 2.5 FABRICATION

- A. General: Fabricate doors in sizes indicated for Project-site fitting.
  - 1. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
- B. Clearances: Additional means of gap covering shall be provided where either code required or the room use dictates privacy.
  - 1. Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, and not more than 1/8 inch between meeting stiles of pairs of doors; 3/4 inch at bottom unless otherwise indicated.
- C. Machining: Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  - 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
- E. 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 or UL 10C.
  - 1. Provide screw-attached metal labels.
  - 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  - 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  - 4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.



F. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-1 or Grade LD-2, made with binder containing no urea-formaldehyde.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

G. 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.
  - a. 5-inch top-rail blocking.
  - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
  - c. 5-inch midrail blocking, in doors indicated to have armor plates.
  - d. Provide lock blocks, as required, in doors indicated to have exit devices.
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.
  - a. Screw-Holding Capability: Minimum 550 lbf per WDMA T.M.-10.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jams.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer. Machine doors for hardware. Seal cut surfaces after fitting and machining.
  - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
  - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

## SECTION 083113 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Access doors.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of access door assembly specified, including details of construction relative to materials, individual components, profiles, finishes, and fire-protection ratings (if required).

1. Include complete schedule, including types, general locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

- B. Shop Drawings: Showing fabrication and installation of customized access doors and frames, including details of each frame type, elevations of door design types, anchorage, and accessory items.

#### 1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain access doors for entire Project from one source and by a single manufacturer.

- B. Fire-Rated Door Assemblies: Provide units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per test method as indicated below, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard size units, which may vary slightly from sizes indicated.

#### 1.4 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed equipment, and indicate on schedule specified under "Submittals" Article.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Karp Associates, Inc.
  2. Milcor, Inc.
  3. Nystrom, Inc.
  4. Williams Brothers Corporation of America

### 2.2 ACCESS DOORS

- A. Insulated, Fire-Rated Access Doors: Self-latching units consisting of frame, trim, door, insulation, and hardware, including automatic closer, interior latch release, and complying with the following requirements:
1. Trimless Frame: Perimeter frame complying with the following requirements:
    - a. Metal: 0.0598-inch- thick steel sheet.
    - b. Frame Configuration: Flange integral with frame and overlapping face of adjoining gypsum board, with surface formed to receive joint compound.
  2. Door: 0.0359-inch- thick steel sheet, welded pan type.
  3. Hinges: Continuous type.
  4. Locks: Key-operated cylinder lock; cylinders to match building keying system.
  5. Insulation: 2-inch- thick mineral-fiber insulation.
  6. Fire-Protection Rating for Walls: 1-1/2 hours with a temperature rise not exceeding 250 degrees F at the end of 30 minutes.
  7. Fire-Protection Rating for Ceilings: 1 hour combustible or 3 hour non-combustible as required for constructed indicated.
- B. Noninsulated, Fire-Rated Doors for Walls: Self-latching units consisting of frame, trim, door, and hardware, including automatic closer, interior latch release, and complying with the following requirements:
1. Frame: 0.0598-inch- thick steel sheet.
  2. Door: 0.0598-inch- thick steel sheet.
  3. Hinge: Continuous type.
  4. Locks: Key-operated cylinder lock; cylinders to match building keying system.
  5. Fire-Protection Rating for Walls: 1-1/2 hours.
- C. Trimless, Flush Access Doors for Gypsum Board: Units consisting of frame, concealed edge trim, door, hardware, and complying with the following requirements:
1. Frame: 0.0598-inch- thick steel sheet.
  2. Door: 0.0747-inch- thick steel sheet.

3. Concealed, Gypsum Board Edge Trim: 0.0299-inch zinc-coated or galvanized-steel sheet with face flange formed to receive joint compound.
  4. Hinge: Concealed spring pin or continuous type.
  5. Locks: Key-operated cylinder lock; cylinders to match building keying system.
- D. Concealed Frame Access Doors for Gypsum Board Ceilings: Provide with gypsum board insert.
1. Product and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
    - a. Model CTWB; JL Industries, Inc.

## 2.3 FABRICATION

- A. General: Manufacture each access door assembly as an integral unit ready for installation.
1. Door Sizes: Size doors as required for applications indicated.
- B. Access Doors and Frames: Continuous welded construction. Grind welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. Exposed Flange: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
  2. For gypsum board assemblies or gypsum veneer plaster, furnish frames with edge trim for gypsum board or gypsum base.
  3. For installation in masonry construction, furnish frames with adjustable metal masonry anchors.
- C. Locking Devices: Furnish number required to hold door in flush, smooth plane when closed.
1. Provide cylinder locks, furnish 2 keys per lock and key all locks alike and key to match building system.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Advise Installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access doors that must be built into other construction. Coordinate delivery with other work to avoid delay.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's instructions for installing access doors.
  - 1. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.
  - 2. Paint exposed surface of access doors and frames to match adjacent surface finish.

### 3.3 ADJUST AND CLEAN

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

## SECTION 083213 - SLIDING ALUMINUM-FRAMED GLASS DOORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Sliding balcony doors.

#### 1.2 CODE COMPLIANCE

- A. Exterior sliding aluminum-framed glass doors shall meet the requirements of the Florida Building Code.
  - 1. Provide product evaluations and installation requirements indicating compliance with Code requirements.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide sliding aluminum-framed glass doors capable of complying with performance requirements indicated, based on testing manufacturer's sliding doors that are representative of those specified, and that are of minimum test size required by AAMA/WDMA/CSA 101/I.S.2/A440.
- B. Structural Performance: Provide sliding aluminum-framed glass doors capable of withstanding the effects of the following loads, based on testing units representative of those indicated for Project that pass AAMA/WDMA/CSA 101/I.S.2/A440, Uniform Load Structural Test:
- C. Structural Loads:
  - 1. Wind Loads: As indicated.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

#### 1.4 SUBMITTALS

- A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.

- B. Product Data: For each doors indicated.
- C. Shop Drawings: For sliding aluminum-framed glass doors. Include plans, elevations, sections, details, hardware, attachments to other work, and operational clearances.
- D. Samples: For exposed finish specified.
- E. Product test reports.
- F. Sample warranty.
- G. Maintenance data.

#### 1.5 QUALITY ASSURANCE

- A. Installer: A qualified installer, approved by manufacturer to install manufacturer's products.
- B. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201.
- C. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

#### 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of sliding aluminum-framed glass doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure to meet performance requirements.
    - b. Structural failures including excessive deflection.
    - c. Water leakage or air infiltration.
    - d. Faulty operation of movable sash and hardware.
    - e. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - f. Deterioration of insulating glass as defined in Section 088000 "Glazing."
  - 2. Warranty Period:
    - a. Sliding Door: Three years from date of Substantial Completion.
    - b. Glazing: 10 years from date of Substantial Completion.
    - c. Metal Finish: 20 years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 SLIDING BALCONY DOORS

#### A. Model and Manufacturer – Basis of Design: YSD 700H; YKK AP America, Inc.

##### 1. Florida Product Approval Number: FL6377.1

- a. Insulated/Laminated Glass: 1-5/16 inch thick; tinted, insulated, laminated, impact resistant.

- 1) Product and Manufacturer – Basis of Design: VRE19-59 Modified; Viracon, Inc.

- a) Exterior Lite: 1/4-inch thick fully tempered tinted.
    - b) Airspace: 1/2-inch thick.
    - c) Interior Lite: Laminated; 3/16-inch thick clear heat strengthened glass - 0.075-inch thick Stormguard Interlayer by Viracon Inc. - 3/16-inch thick clear heat strengthened glass.

##### 2. Florida Product Approval Number: FL8753.1

- a. Laminated Glass: Laminated (Large Missile) – Operable Panel

- 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.

- a) Exterior Lite: 1/4-inch thick heat strengthened glass, tinted.
    - b) Interlayer: 0.075 inch thick Vanceva Composite Interlayer by Solutia, Inc.
    - c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.

- b. Laminated Glass: Laminated (Large Missile) – Fixed Panel

- 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.

- a) Exterior Lite: 1/4-inch thick heat strengthened glass, tinted.
    - b) Interlayer: 0.070 inch thick Vanceva Composite Interlayer by Solutia, Inc.
    - c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.

- c. Laminated Glass: Laminated (Small Missile) – Operable Panel

- 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.

- a) Exterior Lite: 1/4-inch thick heat strengthened glass, tinted.

- b) Interlayer: 0.060 inch thick PVB Interlayer Saflex/Keepsafe Maximum by Solutia, Inc.
- c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.
- d. Laminated Glass: Laminated (Small Missile) – Fixed Panel
  - 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
    - a) Exterior Lite: 1/4-inch thick heat strengthened glass, tinted.
    - b) Interlayer: 0.060 inch thick PVB Interlayer Saflex/Keepsafe Maximum by Solutia, Inc.
    - c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.

## 2.2 GLAZING

- A. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

## 2.3 INSECT SCREENS

- A. General: Locate screens on the outside of door and provide for each operable door panel.
- B. Insect Screen Frames: Manufacturer's standard extruded-aluminum or formed-tubular-aluminum members.
  - 1. Finish: Manufacturer's standard.
- C. Glass-Fiber Mesh Fabric: ASTM D 3656, 20-by-20 or 20-by-30 count per sq. in. mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration.
  - 1. Mesh Color: Manufacturer's standard.

## 2.4 FABRICATION

- A. Fabricate sliding aluminum-framed glass doors that are reglazable without dismantling panel framing.
- B. Weep Holes: Provide weep holes and internal drainage passages to conduct infiltrating water to exterior.

## 2.5 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing doors, hardware, accessories, and other components.
- B. Install sliding aluminum-framed glass doors level, plumb, square, true to line, without distortion, warp or rack of frames and panels, or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing, vapor retarders, air barriers, water/weather barriers, and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, to provide weathertight construction.
- D. Install sliding aluminum-framed glass doors and components to drain condensation, water penetrating joints, and moisture migrating within doors to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials according to ASTM E 2112, Section 5.12 "Dissimilar Materials."
- F. Lubricate hardware and moving parts.
- G. Adjust operating panels and screens to provide a tight fit at contact points and weather stripping for smooth operation, without binding, and a weathertight closure.
- H. Adjust hardware for proper alignment, smooth operation, and proper latching without unnecessary force or excessive clearance.
- I. Clean aluminum surfaces immediately after installing sliding doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Avoid damaging protective coatings and finishes. Remove nonpermanent labels, and clean surfaces.
- J. Clean glass immediately after installing sliding aluminum-framed glass doors. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.

- K. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- L. Protect sliding door surfaces from contact with contaminating substances resulting from construction operations. During construction, monitor sliding door surfaces adjacent to and below exterior concrete and masonry surfaces for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact sliding door surfaces, remove contaminants immediately according to manufacturer's written instructions.
- M. Refinish or replace sliding aluminum-framed glass doors with damaged finishes.
- N. Replace damaged components.

END OF SECTION 083213

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Exterior storefront.
  - 2. Exterior entrance doors and frames.

#### 1.2 CODE COMPLIANCE

- A. Exterior entrance glazing system shall meet the requirements of the Florida Building Code.
  - 1. Provide product evaluations and installation requirements indicating compliance with Code requirements.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Building Code Requirements: Provide entrance systems that complies with the requirements of the Florida Building Code.
- B. Performance Requirements: Provide exterior entrance systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.
- C. Glazing Systems: 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.
- D. Structural Loads:
  - 1. Wind Loads: As indicated.
- E. Structural-Support Movement: Provide glazing systems that accommodate structural movements including, but not limited to, sway and deflection.
- F. Dimensional Tolerances: Provide glazing systems that accommodate dimensional tolerances of building frame and other adjacent construction.

- G. Thermal Movements: Provide glazed aluminum systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 100 degrees F.
  2. Test Performance: No buckling, stress on glass, glazing-edge seal failure, sealant failure, excess stress on curtain-wall framing, anchors and fasteners, or reduction of performance when tested according to AAMA 501.5.
    - a. Test Ambient Temperature Range: 100 degrees F.

#### 1.4 SUBMITTALS

- A. Product Approval: Submit current Product Approval documentation in accordance with the Florida Building Code.
- B. Engineering Responsibility: Prepare engineering data, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project as prepared by a professional engineer registered in the state of Florida.
- C. Testing and Labeling: Comply with the Building Code. Submit manufacturer's certification indicating compliance.
- D. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- E. Shop Drawings: Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.
1. Engineering Responsibility: Prepare engineering data for entrance systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project as prepared by a professional engineer registered in the state of Florida.
    - a. Include structural analysis data signed and sealed by professional engineer registered in the state of Florida responsible for their preparation.
    - b. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.
    - c. Include all drawings and installation details required to insure the elements installed on this Project will be installed in the same manner as they were tested and approved.
- F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

- G. Samples for Verification: Of exposed finish selected in manufacturer's standard sizes.
- H. Samples: For the following.
  - 1. Aluminum Framing:
    - a. Samples for Verification: Of exposed metal finish selected in manufacturer's standard sizes.
  - 2. Glass: Glass products, in the form of 12-inch-square Samples for each type of glass indicated.
- I. Test Reports: Provide certified test reports indicating compliance with the Building Code.
- J. Field Test Reports: Field quality-control test reports.
- K. Warranties: Warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing glazing systems similar to those required for this Project and who is acceptable to manufacturer.
  - 1. Engineering Responsibility: Preparation of engineering data including the following:
    - a. Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
    - b. Shop Drawings, pre-construction testing program development, and comprehensive engineering analysis by a qualified professional engineer registered in the state of Florida.
- B. Pre-Installation Conference: Conduct conference at Project site.
  - 1. Review structural load limitations.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review required testing, inspecting, and certifying procedures.
- C. Source Limitations: Obtain each type of entrance system through one source from a single manufacturer.
- D. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type.

- E. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Environmental Limitations for Glass and Glazing: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 degrees F.

#### 1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: Minimum two years from date of Substantial Completion.
- B. 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: 20 years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 EXTERIOR STOREFRONT

- A. Model and Manufacturer – Basis of Design: YHS 50 FI Storefront; YKK AP America, Inc.

1. Florida Product Approval Number: FL14218.2

- a. Insulated/Laminated Glass: 1-5/16 inch thick; tinted, insulated, laminated, impact resistant.

- 1) Product and Manufacturer – Basis of Design: VRE19-59 Modified; Viracon, Inc.

- a) Exterior Lite: 1/4-inch thick fully tempered tinted.  
b) Airspace: 1/2-inch thick.  
c) Interior Lite: Laminated; 1/4-inch thick clear heat strengthened glass - 0.10-inch thick Saflex by Solutia. – 1/4-inch thick clear heat strengthened glass.

- B. Model and Manufacturer – Basis of Design: YHS 50 FS Storefront; YKK AP America, Inc.

1. Florida Product Approval Number: FL14218.4

- a. Laminated Glass:

- 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.

- a) Exterior Lite: 1/4-inch thick heat strengthened glass, tinted.  
b) Interlayer: 0.075 inch thick Saflex by Solutia, Inc.  
c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.

### 2.2 EXTERIOR ENTRANCE DOORS AND FRAMES

- A. Model and Manufacturer – Basis of Design: 35H Medium Stile, Impact Resistant Swing Doors; YKK AP America, Inc.

1. Florida Product Approval Number: FL16554.1

2. Glass:

- a. Insulated/Laminated: 1-inch thick insulated/laminated, tinted, impact glass.
  - 1) Product and Manufacturer – Basis of Design: VRE19-59 Modified; Viracon, Inc.
    - a) Exterior Lite: 3/16-inch thick fully tempered tinted.
    - b) Airspace: 5/16-inch airspace
    - c) Interior Lite: Laminated; 3/16-inch thick heat strengthened glass; 0.090-inch thick Sentryglas by Dupont; 3/16-inch thick heat strengthened glass
- b. Laminated: Nominal 9/16-inch laminated, tinted, impact resistant.
  - 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
    - a) Exterior Lite: 1/4-inch thick heat strengthened glass, tinted.
    - b) Interlayer: 0.090 inch thick Sentryglas by Dupont
    - c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.

2.3 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
  - 1. Sheet and Plate: ASTM B 209.
  - 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
  - 3. Extruded Structural Pipe and Tubes: ASTM B 429.
  - 4. Bars, Rods, and Wire: ASTM B 211.
  - 5. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Steel Reinforcement: Complying with ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.
- C. Glazing Gaskets: As required to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- D. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- E. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.

## 2.4 COMPONENTS

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Reinforce members as required to retain fastener threads.
  - 2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
- B. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 or ASTM A 153 requirements.

## 2.5 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.
  - 1. Entrance Door Hardware Sets: Refer to Section 087100 Door Hardware and the following.
    - a. Weather Stripping: Manufacturer's standard replaceable components.
    - b. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
    - c. Silencers: BHMA A156.16, Grade 1.
    - d. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

## 2.6 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
  - 1. Fabricate components for screw-spline (concealed fastener) frame construction.
  - 2. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
  - 3. Prepare components to receive concealed fasteners and anchor and connection devices.
  - 4. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- B. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. 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. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."
- D. Metal Protection: 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. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

## 2.7 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of glazing systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing glazing systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
- B. Metal Protection: 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. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install the system plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
- D. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.

- E. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.

### 3.3 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure glazing systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084113

## SECTION 084229.23 - SLIDING AUTOMATIC ENTRANCES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Automatic entrance doors.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Automatic sliding door system shall be certified by the manufacturer to meet performance design requirements according to criteria for conducting impact, static, cyclic, air and water tests as set forth by the Miami-Dade County Building Code Compliance Office (BCCO), Product Control Division.
1. Air Infiltration: Tested in accordance with FBC, PA-202-94, ANSI A156.10, and ASTM E 283 at a pressure differential of 1.57 psf for pairs of doors.
  2. Uniform Static Pressure: Tested in accordance with FBC, PA-202-94, and ASTM E-283.
  3. Forced Entry: Tested in accordance with FBC, TAS 203-94.
  4. Large Missile: Tested in accordance with FBC, TAS PA-201-94, and ASTM E 1886 at a door opening of 16 feet wide by 8 feet 8 inches and a maximum door leaf size of 40-1/2 inches wide and a maximum height of 93 inches.
  5. Cyclic Wind Pressure Loading: Tested in accordance with FBC, TAS PA 203-94.
- B. Accessibility Requirements: Comply with requirements of Local building code, and Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities.
- C. System Design: Operate, hold open, and close doors under design wind and suction loads calculated in accordance with applicable building code.
- D. Operating Temperature Range: Minus 35 to plus 130 degrees F ambient.
- E. Operators: Fully adjustable for opening and closing speeds, checking speeds, hold open time, and cancellation on activation of fire alarm and smoke detection system.

#### 1.3 COORDINATION

- A. Templates: Distribute for doors, frames, and other work specified to be factory prepared for installing automatic entrances.
- B. Electrical System Roughing-in: Coordinate layout and installation of automatic entrances with connections to power supplies.

#### 1.4 SUBMITTALS

- A. Product Data: For products indicated.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for automatic entrances.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, hardware mounting heights, and attachment details.
  - 2. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
  - 4. Indicate locations of activation and safety devices.
  - 5. Include hardware schedule and indicate hardware types, functions, quantities, and locations.
- C. Samples for Verification: For exposed finish required, in manufacturer's standard sizes.
- D. Qualification Data: For Installer.
- E. Product Certificates: For each type of automatic entrance. Include emergency-exit features of automatic entrances serving as a required means of egress.
- F. Product Test Reports: For each type of automatic entrance, for tests performed by a qualified testing agency.
- G. Field quality-control reports.
- H. Sample Warranties: For manufacturer's special warranties.
- I. Operation and Maintenance Data: For automatic entrances, safety devices, and control systems to include in operation and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation and maintenance of units required for this Project and who employs a Certified Inspector.
  - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
- C. Certified Inspector Qualifications: Certified by AAADM.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Faulty operation of operators, controls, and hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  2. Warranty Period: Two years from date of Substantial Completion.
- B. Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
1. Warranty Period: Minimum 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 AUTOMATIC ENTRANCE DOORS

- A. Model and Manufacturer – Basis of Design: Series ESA 300 Aluminum Automatic Sliding Glass Door; Dorma Automatics, Inc.
1. Notice of Acceptance Number: 12-1101.01
    - a. Expiration Date: February 1, 2017
  2. Glass: Laminated impact resistant tinted glass; 2 lites of 1/4-inch thick heat strengthened glass with a 0.075-inch thick Solutia Vanceva inner layer.
    - a. Glass Color: Tinted to match Curtain Wall glass.
    - b. Interlayer Color: Clear.
- B. Description: Automatic sliding doors shall be provided as a complete package including doors, frames, operators, and actuators.
1. Electrical Requirements: 120 VAC, single-phase building power supply; low-voltage control wiring.
  2. Glazing Stops: Security type glass stops.
  3. Threshold Track: Adjacent to sidelites and panels; manufacturer's standard.



## 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:
  - 1. Extruded: ASTM B 221.
  - 2. Sheet and Plate: ASTM B 209.
  - 3. Welding Rods and Bare Electrodes: AWS A5.10.
- B. Sealants and Joint Fillers: Refer to Division 7 Section "Joint Sealants" for joints at perimeter of entrance system.
- C. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout; complying with ASTM C 1107; of consistency suitable for application.
- D. Weatherstripping: Entrance manufacturer's standard types to suit application.
- E. Fasteners: Stainless steel.

## 2.3 AUTOMATIC ENTRANCE DOOR SYSTEMS

- A. General: Provide manufacturer's standard automatic entrance door system, complete with doors, sidelite and transom framing, operators, controls, activation devices, safety devices, and accessories as indicated. Comply with the following:
  - 1. Configuration: Automatic sliding door.
    - a. Traffic Pattern: Two-way.
    - b. Emergency Breakaway Capability: Doors and side panels.
    - c. Mounting: As indicated.
  - 2. Door Operator and Controller: DORMA ESA system with an electro-mechanical operator and microprocessor controller. Components shall consist of a DC permanent magnet motor, a self-lubricating drive system and a wear-free digital rotary encoder all linked to a fully integrated digital microprocessor controller.
  - 3. Microprocessor Controller: DORMA microprocessor controller fully integrated digital design, self-learning and self-monitoring.
    - a. Performance parameters shall not exceed applicable ANSI A156.10 and/or UL standards.
    - b. Controller shall continuously monitor all critical door functions and safety sensors.
    - c. All door functions such as opening speed, closing speed, check locations, partial open dimensions, etc., shall be fully programmable without the use of limit switches by utilizing a portable hand terminal connected to the microprocessor controller.

4. Threshold Sensors: Self-monitored active infrared safety sensors. Sensors shall be self-contained and fully functioning during the opening and closing cycle of the door.
5. Activation Sensor: Motion sensor utilizes K-band frequency (24.125 GHz) for improved detection of slow-moving pedestrian traffic, and shall be switchable between bi-directional and uni-directional operation. Circuitry is included to eliminate Radio Frequency Interference (RFI) and Electromagnetic Interference (EMI). Relay hold time is adjustable from 0.5 seconds to 9 seconds.
  - a. Mount motion sensor to the header at 120 inches maximum above the finished floor; detection pattern is semi-circular.
  - b. Location of the detection zone shall be adjustable by moving the antenna. Vertical antenna adjustments shall be possible from 0 degrees to 90 degrees in 15 degrees increments and lateral adjustment from 30 degrees left to 30 degrees right and anywhere in between.
  - c. Power is provided by the microprocessor control. Electrical adjustments made with universal coded infrared remote control.
6. Accessories: ESA-HP 300 automatic sliding door system shall include the following accessories to reduce energy loss:
  - a. Track-in pile weather-stripping on the bottom of sliding door(s).
  - b. Track-in double pile weather-stripping on the sliding door lead edges.
  - c. Track-in single pile weather-stripping between the carrier and the header on the sliding door(s).
  - d. Track-in double pile weather-stripping at the interlock rails between sliding door(s) and sidelite door(s).
  - e. Track-in neoprene weather-stripping between sidelite door(s) and jamb(s).
  - f. Interior side jamb mounted program switches consisting of:
    - 1) Main Switch = AUTO- CLOSE -OPEN (operates door in fully automatic mode or turns it off or keeps it fully open).
    - 2) Exit Only Switch = OFF - ON (only the exit side motion detector will initiate door opening).
    - 3) Partial Open Switch = OFF - ON (reduces the opening width according to weather and traffic conditions).

## 2.4 ELECTRICAL

- A. Electrical: 120 VAC, 60 Hz, 5 Amp service.
- B. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

## 2.5 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, header support, and other conditions affecting performance of automatic entrances.
- B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic entrance installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install automatic entrances according to manufacturer's written instructions for direction of pedestrian travel, including signage, controls, wiring, and connection to the building's power supply.
  - 1. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
  - 2. 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.
  - 3. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous coating.
- 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.
  - 3. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within system to exterior.
  - 4. Level recesses for recessed thresholds using nonshrink grout.

- C. Door Operators: Connect door operators to electrical power distribution system.
- D. Controls: Install and adjust activation and safety devices according to manufacturer's written instructions for direction of pedestrian travel.
- E. Sealants: Comply with requirements specified in Section 079200 "Joint Sealants" to provide weathertight installation.
  - 1. Set thresholds, framing members and flashings in full sealant bed.
  - 2. Seal perimeter of framing members with sealant.
- F. Signage: Apply signage on both sides of each door and breakaway sidelite as required by cited BHMA standard for direction of pedestrian travel.
- G. 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.

### 3.3 FIELD QUALITY CONTROL

- A. Testing Services: Factory Trained Installer shall test and inspect each automatic entrance door to determine compliance of installed systems with applicable ANSI standards.
- B. Work will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.4 ADJUSTING

- A. Adjust door operators, controls, and hardware for smooth and safe operation, for weather-tight closure, and complying with requirements in ANSI/BHMA A156.10.
- B. Lubricate operating hardware and other moving parts as recommended by manufacturer.
- C. Readjust door operators and controls after repeated operation of completed installation equivalent to 3 days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.
- D. Occupancy Adjustments: Within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

### 3.5 CLEANING

- A. Clean glass and metal surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish.
- B. Provide protection required through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of Final Acceptance.

### 3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of automatic entrance Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper automatic entrance operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Engage a Certified Inspector to perform safety inspection after each adjustment or repair and at end of maintenance period. Furnish completed inspection reports to Owner.
  - 2. Perform maintenance, including emergency callback service, during normal working hours.
  - 3. Include 24-hour-per-day, 7-day-per-week, emergency callback service.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic entrances.

END OF SECTION 084229.23

## SECTION 084413 - GLAZED ALUMINUM CURTAIN WALLS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Glazed aluminum curtain wall systems.

#### 1.2 CODE COMPLIANCE

- A. Exterior glazing systems shall meet the requirements of the Florida Building Code.

#### 1.3 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, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Dimensional tolerances of building frame and other adjacent construction.
  - 3. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
    - f. Water leakage.
- B. Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer.
- C. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
    - a. Basic Wind Speed: As indicated on the Drawings.

D. Structural-Test Performance: Test according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbs/sq.ft.

F. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:

1. Temperature Change (Range): 120 deg F Ambient conditions 180 deg F for material surfaces.
2. Test Performance: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

#### 1.4 SUBMITTALS

- A. Florida Product Approval Certification: Provide current Florida Product Approval documentation.
- B. Product Data: Submit product data for system and products specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- C. Shop Drawings: Include plans, elevations, sections, full-size details, and attachments to other work.
  1. Provide analysis data signed and sealed by a qualified professional engineer registered in the state of Florida and responsible for their preparation.
  2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.

3. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
- D. Samples: For exposed finish specified, in manufacturer's standard sizes.
- E. Qualification Data: For qualified Installer and testing agency.
- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- G. Field quality-control reports.
- H. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
- I. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Professional Engineer Qualifications: The engineer shall be a professional engineer registered in the state of Florida and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of glazed aluminum curtain wall systems that are similar to those indicated for this Project in material, design, and extent.
- D. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."
- E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.
- F. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 WARRANTY

- A. Manufacturer's 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. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.



- b. Noise or vibration caused by thermal movements.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- d. Adhesive or cohesive sealant failures.
- e. Water leakage through fixed glazing and framing areas.
- f. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. 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: Minimum 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GLAZED ALUMINUM CURTAIN WALL SYSTEM – INSULATED/LAMINATED GLASS

A. Product and Manufacturer – Basis of Design: Series YHC 300 IG Aluminum Curtain Wall System – L.M.I.; YKK AP America, Inc., Atlanta, GA

1. Florida Product Approval Number: FL14217.1

a. Insulated/Laminated Glass: 1-5/16 inch thick; tinted, insulated, laminated, impact resistant.

1) Product and Manufacturer – Basis of Design: VRE19-59 Modified as indicated below; Viracon, Inc.

- a) Exterior Lite: 1/4-inch thick fully tempered tinted.
- b) Airspace: 1/2-inch airspace
- c) Interior Lite: Laminated; 1/4-inch thick heat strengthened glass; 0.090-inch thick Sentryglas by Dupont; 1/4-inch thick heat strengthened glass, clear.

## 2.2 GLAZED ALUMINUM CURTAIN WALL SYSTEM – LAMINATED GLASS

### A. Product and Manufacturer – Basis of Design: Series YHC 300 IG Aluminum Curtain Wall System – L.M.I.; YKK AP America, Inc., Atlanta, GA

1. Florida Product Approval Number: FL12610.1 (Large Missile Impact)
  - a. Laminated Glass:
    - 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
      - a) Exterior Lite: 1/4-inch thick heat strengthened glass, clear.
      - b) Interlayer: 0.075 inch thick Venceva composite by Solutia.
      - c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.
2. Florida Product Approval Number: FL12610.2 (Small Missile Impact)
  - a. Laminated Glass: Nominal 9/16-inch thick, tinted, laminated impact resistant.
    - 1) Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
      - a) Exterior Lite: 1/4-inch thick heat strengthened glass, tinted.
      - b) Interlayer: 0.060 inch thick Saflex by Solutia.
      - c) Interior Lite: 1/4-inch thick heat strengthened glass, clear.

## 2.3 MATERIALS

- ### A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
1. Sheet and Plate: ASTM B 209.
  2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Welding Rods and Bare Electrodes: AWS A5.10.
- ### B. Steel Reinforcement: ASTM A 36 for structural shapes, plates, and bars; ASTM A 611 for cold-rolled sheet and strip; or ASTM A 570 for hot-rolled sheet and strip.

## 2.4 ACCESSORIES

- ### A. Manufacturer's Standard Accessories:
1. Fasteners: Zinc plated steel concealed fasteners; Hardened aluminum alloys or AISI 300 series stainless steel fasteners. Joint fasteners may be concealed.
  2. Sealant: Non-skinning type, AAMA 803.3

3. Glazing: Setting blocks, edge blocks, and spacers in accordance with ASTM C 864, shore durometer hardness as recommended by manufacturer; exterior glazing silicone compatible EPDM gaskets, in accordance with ASTM C 864, designed to lock into gasket reglet, interior by means of silicone spacer and structural silicone adhesive.
4. Glazing Adhesive: Type as recommended by manufacturer

## 2.5 FABRICATION

- A. General: Fabricate glazed aluminum curtain wall system according to Shop Drawings. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.6 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. 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 and to prevent impeding movement of moving joints.
  6. Weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
  7. 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 by applying sealant or tape or 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 glazed aluminum curtain wall to exterior.

D. Install components plumb and true in alignment with established lines and grades.

### 3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8-inch in 10 feet; 1/4-inch in 40 feet.
2. Level: 1/8-inch in 10 feet; 1/4-inch in 40 feet.
3. Alignment:
  - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
  - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
  - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

### 3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of representative areas of glazed aluminum curtain walls shall take place as installation proceeds to determine compliance of installed assemblies with specified requirements.

1. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 10 lbf/sq. ft and shall not evidence water penetration.
  - a. Perform a minimum of ten tests in areas as directed by Architect.

- C. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 084413

## SECTION 085113 - ALUMINUM WINDOWS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Aluminum windows.

#### 1.2 CODE COMPLIANCE

A. Window systems shall meet the requirements of the Florida Building Code.

1. Provide product evaluations and installation requirements indicating compliance with Code requirements.

#### 1.3 PERFORMANCE REQUIREMENTS

A. Building Code Requirements: Provide window systems that comply with the requirements of the Florida Building Code.

B. Structural Loads:

1. Wind Loads: As indicated.

#### 1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

E. Product test reports.

F. Sample warranties.

## 1.5 WARRANTY

- A. **Manufacturer's Warranty:** Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals and other materials beyond normal weathering.
    - d. Water penetration.
    - e. Failure of operating components.
  2. Warranty Period: Minimum two years from date of Substantial Completion.
- B. **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: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ALUMINUM WINDOWS

- A. **Fixed Window Units - Model and Manufacturer – Basis of Design:** YOW 225H; YKK AP America Inc.
1. Florida Product Approval Number: FL7569.1
  2. Laminated Glass – Large Missile Impact: Nominal 9/16-inch thick laminated, tinted, impact resistant.
    - a. Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
      - 1) Glass Makeup: 1/4-inch thick heat strengthened glass, 0.090-inch thick PVB interlayer Saflex by Solutia, 1/4-inch thick heat strengthened glass, clear.

3. Laminated Glass – Small Missile Impact: Nominal 9/16-inch thick laminated, tinted, impact resistant.
  - a. Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
    - 1) Glass Makeup: 1/4-inch thick heat strengthened glass, 0.060-inch thick PVB interlayer Saflex by Solutia, 1/4-inch thick heat strengthened glass, clear.
- B. Casement Window Units - Model and Manufacturer – Basis of Design: YOW 225H; YKK AP America Inc.
  1. Florida Product Approval Number: FL9968.2
  2. Laminated Glass – Large Missile Impact: Nominal 9/16-inch thick laminated, tinted, impact resistant.
    - a. Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
      - 1) Glass Makeup: 1/4-inch thick heat strengthened glass, 0.090-inch thick PVB interlayer Saflex by Solutia, 1/4-inch thick heat strengthened glass, clear.
  3. Laminated Glass – Small Missile Impact: Nominal 9/16-inch thick laminated, tinted, impact resistant.
    - a. Product and Manufacturer – Basis of Design: VRE19-57 Modified as indicated below; Viracon, Inc.
      - 1) Glass Makeup: 1/4-inch thick heat strengthened glass, 0.060-inch thick PVB interlayer Saflex by Solutia, 1/4-inch thick heat strengthened glass, clear.
- C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.
- D. Hardware, General: Manufacturer's standard corrosion-resistant hardware.
- E. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.
- F. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
  1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.



## 2.2 INSECT SCREENS

- A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash.
- B. Aluminum Frames: Complying with SMA 1004 or SMA 1201.
- C. Glass-Fiber Mesh Fabric: 20-by-20 (0.85-by-0.85-mm) or 20-by-30 (0.85-by-0.42-mm) mesh complying with ASTM D 3656.
  - 1. Mesh Color: Manufacturer's standard.

## 2.3 FABRICATION

- A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Glaze aluminum windows in the factory.
- C. Weather strip each operable sash to provide weathertight installation.
- D. Provide weep holes and internal passages to conduct infiltrating water to exterior.
- E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.
- F. Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.
- G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

## 2.4 ALUMINUM FINISHES

- A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.
- C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.
- D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- E. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- G. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085113

## SECTION 087100 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Door hardware.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
1. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
  2. Content: Include the following information:
    - a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    - d. Fastenings and other pertinent information.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
- C. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.
- D. Warranty: Warranty specified in this Section.
- E. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

### 1.3 QUALITY ASSURANCE

- A. General: All hardware shall meet the requirements of Federal, State and Local codes having jurisdiction.
- B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
- C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in 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 or UL 10C, unless otherwise indicated.
- D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver keys to Owner.

### 1.5 COORDINATION

- A. Templates: Obtain and distribute to the parties involved 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.
- B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

## 1.6 WARRANTY

- A. Manufacturer's 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. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

## PART 2 - PRODUCTS

### 2.1 DOOR HARDWARE

- A. Hardware Groups: Refer to the Drawings.

### 2.2 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
- B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with 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. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

### 2.3 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
- C. Security: Provide a secure lock-up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items that are not immediately replaceable, so that the completion of the work will not be delayed by hardware losses both before and after installation.

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

### 3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Where door hardware is installed more than one month prior to acceptance or occupancy, return to the installation during the week prior to acceptance or occupancy and make –a final check and adjust all hardware items. Clean operating items as necessary to restore proper function and finish. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

### 3.5 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.

END OF SECTION 087100

## SECTION 088000 - GLAZING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - a. Glass.

#### 1.2 DEFINITIONS

- A. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

#### 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 indicated is minimums and is for detailing only. Confirm glass thickness by analyzing Project loads and in-service conditions.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components.

#### 1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch- square Samples for glass.
1. Each glass type indicated.



## 1.5 QUALITY ASSURANCE

- A. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.
- B. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- C. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
  - 1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
- D. 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" and "Laminated Glass Design Guide."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 degrees F.

## 1.8 WARRANTY

- A. Manufacturer's Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to 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. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 FLOAT GLASS:

- A. ASTM C 1036, Type I, Quality-Q3, Class I (clear).

### 2.2 HEAT TREATED FLOAT GLASS:

- A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent glass, flat); Quality q3 (glazing select); class, kind, and condition as indicated.

### 2.3 LAMINATED GLASS:

- A. 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.

## 2.4 TEMPERED GLASS

### A. Tempered Glass: Clear fully tempered float glass.

1. Thickness: 1/4-inch, minimum.
2. Labeling: Provide safety glazing labeling.

## 2.5 FIRE-RATED GLAZING

### A. Laminated Ceramic Glazing: Laminated fire-rated and impact safety-rated glass complying with 16 CFR 1201, Category I and II.

1. Product and Manufacture – Basis of Design: FireLite Plus Premium Grade; Technical Glass Products (TGP)
  - a. Thickness: Nominal 5/16-inch.
  - b. Fire Rating: Up to 3 hours.

## 2.6 ELASTOMERIC GLAZING SEALANTS

### A. General: Provide products of type indicated, complying with the following requirements:

1. 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.
2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range for this characteristic.

### B. Elastomeric Glazing Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied, chemically curing sealant in the Glazing Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

1. Additional Movement Capability: Where additional movement capability is specified in the Glazing Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at time of installation and remain in compliance with other requirements in ASTM C 920 for uses indicated.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

### A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. 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.

## 2.8 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep system.
  - 3. Minimum required face or edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

### 3.3 GLAZING, GENERAL

- A. 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.
- B. For fire-rated glass use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- C. 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.
- D. 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.
- E. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- F. 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.
- G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- H. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- I. 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.
- J. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 SEALANT GLAZING (WET)

- A. 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.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.5 PROTECTION AND CLEANING

- 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.
- B. 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 them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION 088000

## SECTION 088300 - MIRRORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Mirrors.

#### 1.2 SUBMITTALS

A. Product Data: For the following:

1. Silvered mirrored glass. Include description of materials and process used to produce mirrored glass that indicates source of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include elevations, sections, details, and attachments to other Work.

C. Samples: For each type of the following products:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.

D. Warranty: Sample of special warranty.

#### 1.3 QUALITY ASSURANCE

A. Source Limitations for Mirrored Glass: Obtain mirrored glass from one source for each type of mirrored glass indicated.

B. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each type of accessory indicated.

C. NAAMM's Publication: For silvered mirrored glass, comply with recommendations in NAAMM's "Mirrors, Handle with Extreme Care, Tips for the Professional on the Care and Handling of Mirrors."

D. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to mirrored glass manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. For silvered mirrored glass, comply with mirrored glass manufacturer's written instructions for shipping, storing, and handling mirrored glass 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 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrored glass until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

#### 1.6 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Manufacturer's Special Warranty for Silvered Mirrored Glass: Written warranty, made out to Owner and signed by mirrored glass manufacturer agreeing to replace silvered mirrored 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 manufacture.

### PART 2 - PRODUCTS

#### 2.1 MIRROR GLASS

- A. Mirror Glass: ASTM C 1036, Type I (transparent glass, flat), class, quality, and other properties as indicated below:
  - 1. Clear Annealed Float Glass: Class 1 (clear), Quality q2 (mirror).
    - a. Thickness: 6 mm.
- B. Silvered Mirrored Glass: Annealed, clear float glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard organic protective coating applied to second glass surface to produce a coating system complying with FS DD-M-411.



## 2.2 MISCELLANEOUS MATERIALS

- A. Setting Blocks: Neoprene, 70 to 90 Shore A hardness.
- B. Edge Sealer: Coating compatible with glass coating and approved by mirrored glass manufacturer for use in protecting against silver deterioration at mirrored glass edges.
- C. Mirror Mastic: An adhesive setting compound, asbestos-free, 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. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Franklin International; Titebond Division.
    - b. Laurence, C. R. Co., Inc.
    - c. Palmer Products Corporation.
- D. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- E. Anchors and Inserts: Provide devices as required for installation.

## 2.3 MIRROR HARDWARE

- A. Perimeter Trim: 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, sides and top of each mirror.
  - 1. Manufacturers: Subject to compliance with requirements, manufacturer's providing products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Laurence, C. R. Co., Inc.
    - b. Sommer & Maca Industries, Inc.
  - 2. Finish: Clear bright anodized.

## 2.4 FABRICATION

- A. Mirrored Glass Sizes: Cut mirrored glass to final sizes and shapes to suit Project conditions.
- B. Mirrored Glass Edge Treatment: Beveled edge.

- C. Vinyl-Backed Safety Mirrored Glass: Apply vinyl backing with pressure-sensitive adhesive coating over glass coating as recommended by vinyl-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections. Use adhesives and vinyl backing compatible with mirrored glass as certified by organic coating manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, over which mirrored glass units are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance.
  - 1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
  - 2. Proceed with mirrored glass installation only after unsatisfactory conditions have been corrected and surfaces are dry.

### 3.2 PREPARATION

- A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating surfaces with mastic manufacturer's special bond coating where applicable.

### 3.3 INSTALLATION

- A. General: Install mirrored glass units to comply with written instructions of mirrored glass manufacturer and with referenced GANA and NAAMM publications. Mount mirrored glass accurately in place in a manner that avoids distorting reflected images.
- B. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. 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.
  - 1. Top and Bottom Aluminum J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.

### 3.4 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.

- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 088300

## SECTION 089119 – FIXED LOUVERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Louvers.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide louvers and grilles capable of withstanding the effects of loads and stresses within limits and under conditions indicated without permanent deformation of components, noise or metal fatigue caused by blade rattle or flutter, or permanent damage to fasteners and anchors.

1. Wind Loads: As indicated on Drawings.

- B. Thermal Movements: Provide louvers and vents that allow for thermal movements resulting from ambient temperature changes.

#### 1.3 SUBMITTALS

- A. Product Data: For louvers indicated.
- B. Samples: For metal finish color required.

#### 1.4 WARRANTY

- A. Finish Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period.

1. Warranty Period: Minimum 1 year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LOUVERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. EHH-601D; Greenheck
    - a. Florida Product Approval Number: FL10088
    - b. Blade Orientation: Horizontal.
  2. Louver Depth: 6-inches.
  3. Finish: High-performance organic-coating.

### 2.2 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
1. Screen Location for Fixed Louvers: Interior face.
  2. Screening Type: Bird screening.
- B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.
- C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
  2. Finish: Same finish as louver frames to which louver screens are attached.
  3. Type: Rewirable frames with a driven spline or insert.
- D. Louver Screening for Aluminum Louvers:
1. Bird Screening: Stainless steel, 1/2-inch- square mesh, 0.047-inch wire.

### 2.3 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, alloy 6063-T5.
- B. Aluminum Sheet: ASTM B 209, alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Of same basic metal and alloy as fastened metal or Type 316 stainless steel, unless otherwise indicated. Do not use metals that are incompatible with joined materials.

## 2.4 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### 3.3 INSTALLATION

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Division 07 Section "Joint Sealants" for sealants applied during louver installation.

### 3.4 ADJUSTING AND CLEANING

- A. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 089119

## SECTION 089516 - WALL VENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Wall vents.

#### 1.2 SUBMITTALS

- A. Product Data: For products indicated.

### PART 2 - PRODUCTS

#### 2.1 WALL VENTS

A. Aluminum Wall Vents:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Airolite Company, LLC (The)
  - b. Reliable Products, Inc.
  - c. Sunvent Industries; Division of Sylro Sales Corp.
2. Material: Aluminum; alloy and temper required for application indicated.
3. Finish: Mill.
4. Vent Size: As required to suit exhaust duct size indicated.
5. Dampers: Manufacturer's standard mounted on inside of wall vents.

#### 2.2 MATERIALS

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.



PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Installation accordance with manufacturer's instructions and recommendations.

END OF SECTION 089516

## SECTION 092116.23 - GYPSUM BOARD SHAFT-WALL ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Shaft enclosures.

#### 1.2 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

#### 1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Provide gypsum board shaft-wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.

#### 1.4 SUBMITTALS

- A. Product Data: For each gypsum board shaft-wall assembly indicated.
- B. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft-wall assembly's required fire-resistance rating.
- C. Research/Evaluation Reports: Evidence of compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction that substantiate required fire-resistance rating for each gypsum board shaft-wall assembly.

- D. Acoustical-Test-Response Reports: From a qualified independent testing agency substantiating required STC rating for each gypsum board shaft-wall assembly.

## 1.5 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory" or GA-600, "Fire Resistance Design Manual" as indicated.
- B. STC-Rated Assemblies: For gypsum board shaft-wall assemblies indicated to have STC ratings, provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Management and Coordination." Review methods and procedures for installing work related to gypsum board shaft-wall assemblies including, but not limited to, the following:
  - 1. Fasteners proposed for anchoring steel framing to building structure.
  - 2. Sprayed fire-resistive materials applied to structural framing.
  - 3. Wiring devices in shaft-wall assemblies.
  - 4. Doors and other items penetrating shaft-wall assemblies.
  - 5. Items supported by shaft-wall-assembly framing.
  - 6. Mechanical work enclosed within shaft-wall assemblies.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

## 1.7 PROJECT CONDITIONS

- A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Division 9 Section "Gypsum Board Assemblies."

## 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:
1. G-P Gypsum Corp.
  2. National Gypsum Company.
  3. United States Gypsum Co.

### 2.2 ASSEMBLY MATERIALS

- A. General: 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.
- B. Steel Framing: ASTM C 645.
1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.
- C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness and with moisture-resistant paper faces.
- D. Gypsum Wallboard: ASTM C 36, core type as required by fire-resistance-rated assembly indicated.
1. Edges: Tapered.
- E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Division 9 Section "Gypsum Board Assemblies" that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.
- F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Division 9 Section "Gypsum Board Assemblies."
- G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- H. Track (Runner) 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.
  - 1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
  - 2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft-wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.
- I. Acoustical Sealant: As recommended by gypsum board shaft-wall assembly manufacturer for application indicated.
- J. Sound Attenuation Blankets: ASTM C 665 for Type I, unfaced mineral-fiber-blanket insulation produced by combining thermosetting resins with mineral fibers manufactured from slag or rock wool.

## 2.3 GYPSUM BOARD SHAFT WALL

- A. Deflection Limit:  $L/240$ .
- B. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
  - 1. Depth: As indicated.
- C. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches, in depth matching studs.
  - 1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- D. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft-wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum 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 7 Section "Sprayed Fire-Resistive Materials."
1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (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 on center.
  2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board 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.

### 3.3 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.
  2. Division 9 Section " Gypsum Board Assemblies" for applying and finishing panels.
- B. Testing: Test walls indicated to have STC ratings in accordance with referenced standards.
- C. Do not bridge building expansion joints with shaft-wall assemblies; frame both sides of joints with furring and other support.
- D. 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.
1. At elevator hoistway door frames, provide jamb struts on each side of door frame.
  2. Where handrails directly attach to gypsum board shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.

- E. 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, elevator call buttons, elevator floor indicators, and similar items.
- F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- G. Install control joints to maintain fire-resistance rating of 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 manufacturer's written instructions or ASTM C 919, whichever is more stringent.

END OF SECTION 092116.23

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings and soffits.

#### 1.2 SUBMITTALS

A. Product Data: For each type of product.

#### 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.
- B. 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.
- C. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Interior Wall Framing: Horizontal deflection of  $L/240$  of the wall height under a horizontal load of 5 lbf/sq. ft.



## 2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized.
  3. Depth: As indicated on Drawings.
  4. Minimum Base-Metal Thickness: 0.0188 inch (25 gauge), except as indicated below.
    - a. Provide 3-5/8-inch, 20 DW gauge metal studs at 16 inches on center for walls between 10 to 12 feet in height.
    - b. Provide 3-5/8-inch, 20 STR gauge metal studs at 16 inches on center for walls between 12 to 16 feet in height.
    - c. Provide 0.0312-inch thick studs for framing supporting ceramic tile substrates.
- B. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
  2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Depth: As indicated on Drawings.
- D. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- E. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
1. Depth: As indicated on Drawings.
  2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
  3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- F. Z-Shaped Furring: With slotted or nonslotted web, face flange of Insert depth, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

## 2.3 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch- diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
  - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Furring Channels (Furring Members):
  - 1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
  - 2. Steel Studs: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.0179 inch.
    - b. Depth: As indicated on Drawings.
  - 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: 0.0312 inch.
- E. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. USG Corporation; Drywall Suspension System.

## 2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types and other assembly components indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Stud Spacing: 16-inches on center unless otherwise indicated.

- E. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- F. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- G. Z-Furring Members:
1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
  3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.3 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
  3. Do not attach hangers to steel roof deck.
  4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  6. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

## SECTION 092400 – PORTLAND CEMENT PLASTERING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Portland cement plaster.
  - 2. Metal lath and accessories.

#### 1.2 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Framing for exterior soffit areas shall use framing that is engineered by a professional engineer registered in the state for both positive and negative uplift loading.

#### 1.3 SUBMITTALS

- A. Product Data: Submit product data for each product specified.
- B. Material Certificates: Submit certificate signed by manufacturer for each kind of plaster aggregate certifying that materials comply with requirements.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver cementitious materials to Project site in original packages, containers, or bundles, labeled with manufacturer's name, product brand name, and lot number.
- B. Store materials inside, under cover, and dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

#### 1.5 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.
- B. Installer Requirements:
  - 1. Licensed, insured and engaged in application of portland cement stucco for a minimum of three (3) years.
  - 2. Knowledgeable in the proper use and handling of specified materials.
  - 3. Employ skilled mechanics who are experienced and knowledgeable in specified materials application, and familiar with the requirements of the specified work.

4. Successful completion of minimum of three (3) projects of similar size and complexity to the specified project.
5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with material manufacturer's published specifications and details and the project plans and specifications.

## 1.6 PROJECT CONDITIONS

### A. Exterior Plasterwork:

1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
- B. Prevent uneven or excessive evaporation of moisture from stucco during hot, dry or windy weather. For installation under any of these conditions provide special measures to properly moist cure the stucco.
- C. Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after plaster application.
- D. Protect contiguous work from soiling and moisture deterioration caused by plastering. Provide temporary covering and other provisions necessary to minimize harmful spattering of plaster on other work.

## PART 2 - PRODUCTS

### 2.1 PORTLAND CEMENT PLASTER

#### A. Concrete and Concrete Masonry Substrates:

1. Products and Manufacturer – Basis of Design:
  - a. Sto Powerwall with Sto ExtraSeal; STO Corp., Atlanta, GA

#### B. Gypsum Sheathing Substrate:

1. Product and Manufacturer – Basis of Design:
  - a. StoPowerwall NExT; STO Corp., Atlanta, GA

#### C. Waterproof Air Barrier: StoGuard fluid applied waterproof air barrier consisting of the following components:

1. Sto Gold Fill: Ready mixed acrylic based flexible joint treatment for rough opening protection, joint treatment of wall sheathing, CMU crack repair, and connections with flashing.

2. Sto EmeraldCoat: Ready mixed flexible waterproof coating for wall sheathing, concrete and CMU wall surfaces; StoGold Coat may be substituted for Sto EmeraldCoat.
3. StoGuard Mesh: Nominal 4.2 oz/yd<sup>2</sup> self-adhesive, flexible, symmetrical, interlaced glass fiber mesh, with alkaline resistant coating for compatibility with Sto materials.
4. StoGuard Fabric: Nonwoven cloth reinforcement used to treat sheathing joints, inside and outside corners and rough openings.
5. StoGuard RediCorner: Preformed fabric piece used in the corners of rough openings in tandem with StoGuard Fabric for quicker installation.
6. StoGuard Tape – self adhering rubberized asphalt tape for rough opening protection in wood or metal frame construction, and transition detailing.
7. StoGuard Primer: For use with StoGuard Tape
8. StoGuard RapidSeal: One component quick drying waterproof air barrier material for rough opening protection, sheathing joints (with StoGuard Mesh), CMU crack repair, and transition detailing.

D. Stucco: 103 Sto Powerwall Stucco

E. Primer: Sto Hot Prime.

F. Finish: StoPowerwall Finish; integrally colored, factory blended, acrylic textured finish with graded marble aggregate.

1. Color and Texture: To be selected by the Architect from manufacturer's standard textures.

## 2.2 PORTLAND CEMENT PLASTER – DIRECT APPLIED OVER CMU

A. Product and Manufacturer – Basis of Design: Sto Powerwall with Sto ExtraSeal; STO Corp., Atlanta, GA

1. Seal Coat: Sto ExtraSeal
2. Scratch Coat: Sto ExtraSeal
3. Brown Coat: 103 Sto Powerwall Stucco
4. Finish Coat: StoPowerwall Finish; integrally colored, factory blended, acrylic textured finish with graded marble aggregate.
  - a. Color and Texture: To be selected by the Architect from manufacturer's standard textures.



## 2.3 LATH

- A. Expanded-Metal Lath: ASTM C 847 with ASTM A 653, G60, hot-dip galvanized zinc coating.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Alabama Metal Industries Corporation (AMICO).
    - b. Dale/Incor.
    - c. Marino/Ware; Division of Ware Industries, Inc.
    - d. Western Metal Lath & Steel Framing Systems.
  - 2. Diamond-Mesh Lath: Self-furring.
    - a. Weight: 3.4 lb/sq. yd.
  - 3. Diamond-Mesh Lath: Comply with the following requirements:
    - a. Configuration: Self-furring.
- B. Building Paper: FS UU-B-790, Type I Grade D, Style 2 vapor-permeable paper, 60-minute water resistance.
  - 1. Provide for all portland cement plaster locations.

## 2.4 ACCESSORIES

- A. Joints and Accessories:
  - 1. Provide two piece expansion joints in the stucco system where building movement is anticipated: at joints in the substrate or supporting construction, where the system is to be installed over dissimilar construction or substrates, at changes in building height, at floor lines, at columns and cantilevered areas.
  - 2. Provide one piece expansion joints every 144 ft<sup>2</sup>. Cut and wire tie lath to the expansion joint accessory so lath is discontinuous at or beneath the accessory. Do not exceed length to width ratio of 2-1/2:1 in expansion joint layout and do not exceed more than 18 feet in any direction without an expansion joint. Where casing bead is used back-to-back as the expansion joint, back the joint with barrier membrane.
  - 3. Provide one piece expansion joints at through wall penetrations including above and below doors or windows.
  - 4. Provide minimum 3/8 inch wide joints where the system abuts windows, doors and other through wall penetrations.
  - 5. Provide appropriate accessories at stucco terminations and joints.
  - 6. Provide sealant at stucco terminations and at stucco accessory butt joints.

- B. Weep screed, casing bead, corner bead, corner lath, and expansion and control joint accessories. All accessories shall meet the requirements of ASTM C 1063 and its referenced documents
  - 1. PVC plastic in compliance with ASTM D 1784, cell classification 13244C.
- C. All accessories shall have perforated or expanded flanges and shall be designed with grounds for the specified thickness of stucco.
- D. Mechanical Fasteners: Types recommended by the manufacturer for applications indicated.

## 2.5 JOB MIXED INGREDIENTS

- A. Water: Clean and potable.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect Surfaces for the Following:
  - 1. Contamination: Algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substances.
  - 2. Surface absorption and chalkiness.
  - 3. Cracks: Measure crack width and record location of cracks.
  - 4. Damage and deterioration.
  - 5. Moisture Damage: Record any areas of moisture damage.
- B. Inspect sheathing application for compliance with plaster manufacturer's requirements.
- C. Report deviations from the requirements of project specifications or other conditions that might adversely affect the stucco installation to the General Contractor.

### 3.2 SURFACE PREPARATION

- A. General: Prepare surfaces in accordance with manufacturer's instructions and recommendations.

### 3.3 INSTALLATION OF PLASTERING ACCESSORIES

- A. General: Comply with manufacturer's installation instructions and recommendations.

B. Weep Screed Installation:

1. Install foundation weep screed at the base of the wall securely to framing with the appropriate fastener. Locate foundation weep screed so that it overlaps the joint between the foundation and framing by a minimum of 1-inch. Locate the foundation weep screed minimum 4 inches above earth grade, 2 inches above finished grade (paved surfaces, for example).

C. Weather Protection:

1. Protect sills of rough openings with barrier membrane.
2. Apply moisture barrier in compliance with the applicable building code. Wrap paper into rough opening and lap over barrier membrane at jambs. Lap paper over foundation weep screed attachment flange and window/door head flashings. Comply with plaster manufacturer's instructions and recommendations.

D. Casing Bead and Expansion Joint Installation:

1. Install casing beads at stucco terminations including doors, windows and other through wall penetrations.
2. Install expansion joints (or back-to-back casing beads) at building expansion joints, where the stucco is to be installed over dissimilar construction or substrates, at locations indicated and approved by Architect.
  - a. Install one piece expansion joints at corners of windows, doors, and similar through wall penetrations, and every 144 ft<sup>2</sup>. Install full accessory pieces where possible and avoid small pieces. Seal adjoining pieces by embedding ends in sealant. Abut horizontal into vertical joint accessories. Attach at no more than 7 inches into framing with appropriate fasteners.

E. Control Joints: Install at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Architect:

1. As required to delineate plasterwork into areas (panels) of the following maximum sizes:
  - a. Vertical Surfaces: 144 square feet.
  - b. Horizontal and other Non-vertical Surfaces: 100 square feet.
2. At distances between control joints of not greater than 18 feet on center.
3. As required to delineate plasterwork into areas (panels) with length-to-width ratios of not greater than 2-1/2:1.
4. Where control joints occur in surface of construction directly behind plaster.
5. Where plasterwork areas change dimensions, to delineate rectangular-shaped areas (panels) and to relieve the stress that occurs at the corner formed by the dimension change.

F. Lath Installation:

1. Diamond Mesh Metal Lath: Install metal lath with the long dimension at right angles to structural framing. Terminate lath at expansion joints. Do not install continuously beneath joints.
  - a. Seams/Overlaps: Overlap side seams minimum 1/2 inch and end seams minimum 1 inch. Stagger end seams. Overlap casing beads and expansion joints minimum 1 inch over narrow wing accessories, minimum 2 inches over expanded flange accessories. Do not install lath continuously beneath expansion joints.
  - b. Attachment: Fasten securely through sheathing into structural framing at 7 inches on center maximum vertically and 16 inches on center horizontally. Wire tie at no more than 9 inches on center at: side laps, accessory overlaps, and where end laps occur between supports.

G. One Piece Expansion Joint Installation:

1. Install one piece expansion joints over lath at through wall penetrations, for example, above and below doors or windows. Install one piece expansion joints over lath every 144 ft<sup>2</sup>. Wire tie one piece expansion joints to lath at no more than 7 inches on center. Make certain lath is discontinuous beneath joints.

H. Inside and Outside Corners:

1. Install corner lath at inside corners and corner bead at outside corners over lath. Attach through lath into framing at no more than 7 inches on center with appropriate fasteners.

I. Stucco Installation:

1. Scratch Coat: Apply stucco with sufficient pressure to key into and embed the metal lath. Apply sufficient material to cover the metal lath and to permit scoring the surface. Score the stucco upon completion of each panel in preparation for a second coat. Score horizontally.
2. Brown Coat: As soon as the first coat is firm enough to receive the second coat without damage, apply the second coat. Alternatively, moist cure the first coat up to 48 hours and dampen the scratched surface with water immediately before applying the second coat. Apply the second coat with sufficient pressure to ensure intimate contact with the first coat and as needed to bring the stucco to a uniform thickness that matches the grounds of the accessories. Use a rod or straight edge to bring the surface to a true, even plane. Fill depressions in plane with stucco. Final thickness of stucco shall be minimum 1/2 inch, maximum 7/8 inch.
3. After the stucco has become slightly firm float the surface lightly with a darby or wood float to densify the surface and to provide a smooth, even surface.
4. Moist cure after the stucco has set by lightly fogging for at least 48 hours. Fog as frequently as required during the 48 hour period to prevent loss of moisture from the stucco. Avoid eroding the stucco surface with excess moisture. If relative humidity exceeds 75% the frequency of moist curing can be diminished.

- J. Primer Installation: Moist cure stucco for a minimum of 48 hours. Apply primer evenly with brush, roller or proper spray equipment over the clean, dry stucco and foam build-outs, and allow to dry before applying finish.
- K. Finish Installation:
1. Apply finish to primed stucco and foam build-outs when dry. Apply finish by spraying or troweling with a stainless steel trowel, depending on the finish specified. Follow these general rules for application of finish:
  2. Avoid application in direct sunlight.
  3. Apply finish in a continuous application, and work a wet edge towards the unfinished wall area. Work to an architectural break in the wall before stopping to avoid cold joints.
  4. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying. Adjustments in the scheduling of work may be required to achieve desired results; cool or damp conditions extend working time and retard drying and may require added measures of protection against wind, dust, dirt, rain and freezing. Adjust work schedule and provide protection.
  5. Float finishes with a plastic float to achieve selected texture.
  6. Do not install separate batches of finish side-by-side.
  7. Do not apply finish into or over joints or accessories. Apply finish to outside face of wall only.
  8. Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the requirements of the project specifications.

### 3.4 CUTTING AND PATCHING

- A. Cut, patch, replace, repair, and point up plaster as necessary to accommodate other work. Repair cracks and indented surfaces. Point-up finish plaster surfaces around items that are built into or penetrate plaster surfaces. Repair or replace work to eliminate blisters, buckles, check cracking, dry outs, efflorescence, and similar defects. Repair or replace work as necessary to comply with required visual effects.

### 3.5 CLEANING AND PROTECTING

- A. Remove temporary covering and other provisions made to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows, and other surfaces not to be plastered. Repair surfaces stained, marred or otherwise damaged during plastering work. When plastering work is completed, remove unused materials, containers, equipment, and plaster debris.
- B. Provide protection of installed materials from water infiltration into or behind them.
- C. Provide protection of installed stucco from dust, dirt, precipitation, and freezing.
- D. Provide protection of installed primer and finish from dust, dirt, precipitation, freezing and continuous high humidity until fully dry.

- E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure plaster work is without damage or deterioration at the time of Substantial Completion.

### 3.6 PLASTER REPAIRS

- A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

END OF SECTION 092400

## SECTION 092900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Interior gypsum board.
  2. Tile backer board.

#### 1.2 SUBMITTALS

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

#### 1.3 QUALITY ASSURANCE

- 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.
- C. Protected Openings Identification: All corridor partitions, smokestop partitions, horizontal exit partitions, exit enclosures, and fire rated walls required to have protected openings shall be effectively and permanently identified with signs or stenciling as follows.
1. Locate identification above ceiling areas and in concealed spaces. Provide the following wording: "FIRE AND SMOKE BARRIER PROTECT ALL OPENINGS".
    - a. Letter Size: 2-inches high
    - b. Spacing: 4 feet on center, maximum.
    - c. Letter Font: Helvetica Regular
    - d. Letter Color: Red.
  2. Also provide a 3-inch wide painted red line below the identification signage to identify the direction and extent/length of the rated wall. Extend the painted line the full length of the wall; identify directional changes and where rated walls end.

#### 1.4 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### PART 2 - PRODUCTS

#### 2.1 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. G-P Gypsum.
    - b. Lafarge North America Inc.
    - c. National Gypsum Company.
    - d. USG Corporation.
- B. Regular Type and Type X (fire rated):
  - 1. Thickness: 1/2 inch.
  - 2. Long Edges: Tapered.
- C. Tile Backer Board:
  - 1. Product and Manufacturer – Basis of Design: DensShield Tile Backer; Georgia-Pacific
    - a. Thickness: As indicated on Drawings.



D. Abuse-Resistant Gypsum Board: ASTM C 1629.

1. Products and Manufactures: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fiberock VHI (Very High Impact) Abuse-Resistant Interior Panels: USG Corporation.
2. Thickness: As indicated on Drawings.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.

1. Thickness: As indicated on Drawings.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

F. Acoustically Enhanced Gypsum Board: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.

1. Products and Manufactures: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Sound Break; National Gypsum Company
  - b. Quiet Rock; Quiet Solution
2. Thickness: As indicated on Drawings.
3. Long Edges: Tapered.

2.2 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Paper-faced galvanized steel sheet.
2. Shapes: As indicated.

## 2.3 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Backer Board: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
- D. Joint Compound for Backer Board: As recommended by backer unit manufacturer.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  - 2. For fastening backer board, use screws of type and size recommended by panel manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS

- A. General: 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- 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. Tile Backer Board Units: Comply with manufacture's instructions and recommendations.
  - 1. Where backer board units abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.
- E. Penetrations:
  - 1. Refer to Section 07 84 13 Penetration Firestopping regarding sealing of wall and ceiling penetrations.
  - 2. Seal around all non-fire rated penetrations of gypsum panel walls and ceilings completely to minimum of Smoketight requirements.

### 3.3 INSTALLING TRIM ACCESSORIES

- A. General: Attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 in specific locations identified, where approved by Architect, as indicated on the Drawings, and as follows:
  - 1. Ceilings: Unless otherwise indicated install control joints as follows:
    - a. Install control joints in areas exceeding 2500 sq. ft.
    - b. Space control joints not more than 50 feet on center.
    - c. Install control joints where ceiling framing or furring changes direction.
  - 2. Partitions and Furring: Unless otherwise indicated install control joints as follows:
    - a. Install control joints in partitions and wall furring runs exceeding 30 feet.
    - b. Space control joints not more than 30 feet on center.
    - c. Install control joints in furred assemblies where control joints occur in base exterior wall.

### 3.4 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 3: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 4: All other locations.
  - 3. Level 5: Locations indicated on the Drawings.
- E. Tile Backer Board Units: Finish according to manufacturer's written instructions.

### 3.5 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, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or 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 092900

## SECTION 093000 - TILING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Tile.
2. Waterproofing and crack suppression membrane.

#### 1.2 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Stone thresholds in 6-inch lengths.

#### 1.3 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.

1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:

1. Stone thresholds.
2. Joint sealants.

D. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

#### 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed, for each type, composition, color, pattern, and size indicated.
  - 2. Grout: Furnish quantity of grout equal to 5 percent of amount installed for each color and type indicated.
- B. All extra materials shall be in original manufacturers' containers, sealed, marked with stock number, color number, tile name, etc. Deliver to Owner with a transmittal sheet indicating each item and quantity.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements, unless otherwise indicated.

2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

## 2.2 TILE

- A. Products and Manufacturers - No Substitutions: Refer to the Finish Legend.

## 2.3 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.

- B. Stone Thresholds: As indicated on the Drawings.

1. Size: As indicated.

## 2.4 WATERPROOFING AND CRACK SUPPRESSION MEMBRANE

- A. Acceptable Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Mapelastic HPG; MAPEI Corporation

## 2.5 SOUND REDUCTION MEMBRANE

- A. Acceptable Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. Mapesonic 2; MAPEI Corporation

## 2.6 SETTING AND GROUTING MATERIALS

- A. Thin Set Mortar for Wall and Floor Tile: ANSI A118.4, consisting of the following:
  - 1. Acceptable Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
    - a. Granirapid System; MAPEI Corporation
- B. Grout: ANSI A118.7, color to be selected by the Architect from manufacturer's full line.
  - 1. Acceptable Products and Manufacturer: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
    - a. Ultracolor Plus; MAPEI Corporation

## 2.7 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

## 2.8 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

## 2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
  - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
  - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 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. Provide concrete substrates for tile floors installed with thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
  - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
  - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. For all thin-set tile applications prepare substrates to receive waterproofing and fracture membrane materials in accordance with manufacturer's instructions and recommendations.
- E. Field-Applied Temporary Protective Coating: Where recommended by the tile manufacturer or as 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.

### 3.3 INSTALLATION, GENERAL

- A. Workmanship and Visual Appearance: All tile shall be installed with zero-lippage, with straight and even joints, and smooth and flat. The intent is that all tile installations are to be installed using the best of techniques. Any tile that does not meet or exceed the requirements indicated shall be removed and replaced in accordance with specified requirements.
- B. 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.
- C. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods for applications indicated.
- D. 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.
- E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- F. 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.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated 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 7 Section "Joint Sealants."
- H. Grout tile to comply with requirements of the following tile installation standards:
  - 1. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

### 3.4 WATERPROOFING AND CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install waterproofing to comply with manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

- B. Do not install tile or setting materials until membrane has cured and been tested to determine that it is watertight.

### 3.5 SOUND REDUCTION MEMBRANE INSTALLATION

- A. Install materials to comply with manufacturer's written instructions.

### 3.6 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with TCA installation methods and ANSI A108 Series of tile installation standards for applications indicated.
- B. Joint Widths: Install tile on floors with the following joint widths:
  - 1. Tile: 1/8 inch.
- C. 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.

### 3.7 WALL TILE INSTALLATION

- A. General: Install types of tile designated for wall installations to comply with TCA installation methods and ANSI setting-bed standards for applications indicated.
- B. Joint Widths: Install tile on walls with the following joint widths:
  - 1. Tile: 1/8 inch.

### 3.8 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove latex-portland cement grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
  - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093000

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Acoustical ceiling tile.
  - 2. Exposed grid suspension systems.

#### 1.2 SUBMITTALS

- A. Product Data: For products indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Ceiling Panels: Set of 12-inch- square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch-long Samples of each type, finish, and color.
- C. Maintenance Data: For ceiling panels and grid.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations:
  - 1. Ceiling Panels: Obtain through one source from a single manufacturer.
  - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
    - a. Smoke-Developed Index: 450 or less.
- C. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

### PART 2 - PRODUCTS

#### 2.1 ACOUSTICAL TILE

- A. Product and Manufacturer – Basis of Design: Fine Fissured Square Lay-in; Armstrong World Industries, Inc.
  - 1. Item #:1728.
  - 2. Dimensions: 24 inches x 24 inches x 5/8 inch thick.
  - 3. Color: To be selected by the Architect from manufacturer's standard colors.

#### 2.2 GRID SYSTEMS, GENERAL

- A. Product and Manufacture – Basis of Design: Prelude XL Fire Guard; Armstrong World Industries, Inc.
  - 1. Color: To be selected by the Architect from manufacturer's standard colors.

- B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 653.
  - 1. Structural Classification: Intermediate-duty system.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
  - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
    - a. Type: Postinstalled expansion anchors.
    - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
  - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three 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- diameter wire.

## 2.3 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers:
  - 1. Armstrong World Industries, Inc.
  - 2. Chicago Metallic Corporation.
  - 3. Fry Reglet Corporation.
  - 4. MM Systems, Inc.
  - 5. USG Interiors, Inc.

- B. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
  - 1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

## 2.4 ACOUSTICAL SEALANT

- A. Products:
  - 1. Acoustical Sealant for Exposed and Concealed Joints:
    - a. Pecora Corp; AC-20 FTR Acoustical and Insulation Sealant.
    - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.



### 3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 6. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  - 1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  - 2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

#### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## SECTION 095143 - ACOUSTICAL WOOD PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Acoustical wood panel ceiling system.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Ceiling Panel: 12-inch- square Sample of panel with final finish.
- C. Shop Drawings: Layout and details of ceilings. Show locations of items which are to be coordinated with, or supported by the ceilings.
- D. Maintenance Data: For ceiling panels.

#### 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Surface-Burning Characteristics: Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 for Class A products.
    - a. Smoke-Developed Index: 50 or less.
  - 2. HPVA (Hardwood Plywood and Veneer Association) certification and audit program per ASTM E-84 tunnel test.
- B. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## 1.6 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## 1.7 1.8 WARRANTY

- A. Wood Veneer Panel: Submit manufacturer's written warranty agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
  - 1. Ceiling Panels: Defects in materials or factory workmanship
  - 2. Grid System: Rusting and manufacturer's defects
- B. Warranty Period:
  - 1. Wood veneer panels: One (1) year from date of Substantial Completion.
  - 2. Grid: Ten years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 ACOUSTICAL WOOD PANEL CEILING SYSTEM

- A. Product and Manufacturer – Basis of Design: WoodWorks Channeled Tegal; Armstrong World Industries, Inc.
  - 1. Item #:5904W7
  - 2. Dimensions: 24 inches x 24 inches
  - 3. Species: Natural Variations Maple
  - 4. Finish: Manufacturer's standard natural veneer - Natural Variations, color to be selected by the Architect from manufacturer's full line.
  - 5. Surface Texture: Smooth

6. Composition: Medium Density Fiberboard
7. Perforation Options: To be selected by the Architect from manufacturer's full line.
8. Edge Banding and Trim: To match face veneer.
9. Noise Reduction Coefficient (NRC): ASTM C 423, Classified with UL label on product carton, 0.75
10. Flame Spread: Class A (HPVA)

B. Accessories:

1. BioAcoustic Infill Panel: Flame Spread, Smoke Development Class A; 24 inches x 24 inches x 5/8-inch, color-beige, item #5479.

## 2.2 SUSPENSION SYSTEM

A. Product and Manufacture – Basis of Design: Suprafine XL 9/16" Exposed Tee; Armstrong World Industries, Inc.

1. Color: To be selected by the Architect from manufacturer's standard colors.

B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 653.

1. Structural Classification: Heavy-duty system.

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: Provide wires complying with the following requirements:

1. Zinc-Coated Carbon-Steel Wire: ASTM A 641, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at three 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- diameter wire.

E. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of the same width as exposed runner.

F. Accessories

1. 4 inch Woodworks Trim with wood substrate; 8 foot x 3/4inch x 4 inches, item #5659W1; finish to match panel.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

- A. Install suspension system and panels in compliance with ASTM C636; CISCA Seismic Guidelines; approved construction drawings; with the authorities having jurisdiction; and in accordance with the manufacturer's installation instructions, WoodWorks Channeled Tegular Ceilings Installation Instructions, LA-295693.
- B. Suspend main beam from overhead construction with hanger wires spaced 4 feet on center along the length of the main runner. Install hanger wires plumb and straight. Hanger wires shall not be installed in convenience holes. The suspension system must be leveled to within 1/4 inch in 10 feet and must be square to within 1/16 inch in 2 feet.
- C. Suspend main beam from overhead construction with hanger wires spaced 4 feet on center along the length of the main runner. Install hanger wires plumb and straight. The suspension system must be leveled to within 1/4 inch in 10 feet and must be square to within 1/16 inch in 2 feet.
- D. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.
- E. Follow the instructions found in "WoodWorks Channeled Tegular Ceiling Installation Instructions", LA-295693 for border treatment of the WoodWorks Channeled Vector Ceiling panels. The face of the suspension system rests directly on the molding or trim flange.
- F. Cut panel edges that are exposed to view will have to be treated to look like factory edges. Pre-finished peel and stick edge banding is recommended for this purpose.

3.4 ADJUSTING AND CLEANING

- A. Replace damaged and broken panels.
- B. Clean exposed surfaces of ceilings panels, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095143

## SECTION 096566 - RESILIENT ATHLETIC FLOORING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Athletic flooring.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

1. Submit manufacturer's product and maintenance data for each type of Resilient Athletic Flooring and accessory.
2. Submit color selection in the form of actual sections of Resilient Athletic Flooring, including accessories, for each type of Resilient Athletic Flooring required showing full range of colors and patterns available.

B. Shop Drawings: Show installation details and locations of the following:

1. Locations of floor inserts for athletic equipment installed through flooring.
2. Seam locations for sheet flooring.

C. Samples for Verification: For flooring indicated, 6-inch- square Samples of same thickness and material indicated for the Work.

1. Seam Samples: For flooring color and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

D. Qualification Data: For qualified flooring Installer.

E. Maintenance Data: For flooring to include in maintenance manuals.

#### 1.3 QUALITY ASSURANCE

- A. Single-Source Responsibility for Flooring: Obtain each type, color and pattern of flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the work.



- B. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E648.
  - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E662.
- C. Flooring Installer Qualifications: An experienced Installer who has completed flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver Resilient Athletic Flooring and installation accessories to Project site in original manufacturer's unopened containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 degrees F. and 90 degrees F. Store flooring materials on flat surfaces. Move Resilient Athletic Flooring and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

#### 1.5 FIELD CONDITIONS

- A. Maintain temperatures during installation within range recommended in writing by manufacturer in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
- B. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer.
- C. Do not install athletic flooring until it is at the same temperature as the space where they are to be installed. Close spaces to traffic during athletic flooring installation.
- D. Close spaces to traffic during flooring installation.
- E. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- F. Install flooring after other finishing operations, including painting, have been completed.

## 1.6 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

## 1.7 EXTRA MATERIALS

- A. At the time of building acceptance, deliver to the Owner the following extra materials. Deliver in original unopened cartons or containers with each item properly identified.
  - 1. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
    - a. Furnish not less than one box of athletic flooring tile installed.

## PART 2 - PRODUCTS

### 2.1 ATHLETIC FLOORING

- A. Product and Manufacturer – Basis of Design: Refer to the Finish Legend.
- B. All athletic flooring shall be the maximum extent possible of a single batch number.

### 2.2 ACCESSORIES

- A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.
- B. Trowelable Underlayments and Patching Compounds: to be supplied and/or recommended and approved by rubber athletic flooring Manufacturer for applications indicated.
- C. Concrete Leveling and Patching compounds:
  - 1. For areas up to 4 square feet:
    - a. Feather finish, use to smooth ridges, fill cracks, gouges and joints.
      - 1) "SD-F"; Ardex
    - b. Trowelable underlayment patch for thickness up to ½ inch without aggregate; up to 1 inch with aggregate. Can be feather edged.
      - 1) "SD-P/ Primer P-82"; Ardex

2. For areas exceeding 4 square feet:
  - a. Self-leveling, pourable or pumpable underlayment for thicknesses up to 5 inches. Can be feather edged.
    - 1) "K-15/Primer P-51"; Ardex
- D. Resilient Athletic Flooring Adhesives to be certified by the flooring manufacturer to suit flooring and substrate conditions.
- E. Other materials, including edge strips not specifically described, but required for a complete and proper installation of athletic flooring, shall be only as recommended by the manufacturer of material to which it is applied.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Installer shall examine the areas and conditions under which resilient flooring and accessories are to be installed and notify the Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
  1. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
  2. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. General: Prepare substrates according to manufacturer's written recommendations.
- B. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

- C. Remove coatings, including curing compounds, adhesives, plastics, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush. Surface to receive new flooring shall be prepared, including removal of existing materials not acceptable for proper installation of new materials, as required by manufacturer. Do not use solvents.
  - 1. Prep floor according to ASTM F710 criteria.
- D. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in subfloors.
- E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 CONCRETE SUBFLOORS

- A. Concrete subfloors to be placed a minimum of twenty-eight (28) days prior to the installation of rubber athletic flooring.
- B. Verify that concrete slabs comply with ASTM F710 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, residual adhesives, adhesive removers, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer.
  - 2. Finishes of subfloors comply with tolerances and other requirements specified in Division 03 Section, "Cast-In-Place Concrete" for slabs receiving resilient flooring.
  - 3. Subfloor Moisture Conditions: Before installing flooring Contractor shall verify that Moisture emission rate of not more than 3 lb/1000 sq. ft./24 hours when tested by calcium chloride moisture test in compliance with CRI 104, 6.2.1 and does not exceed the capacity of the specified adhesive, with subfloor temperatures not less than 55 deg F, or as recommended by manufacturer.
  - 4. Subfloor Alkalinity Conditions: Before installing flooring Contractor shall verify that a pH range of 7 to 8.5 when subfloor is wetted with potable water and pHdriion paper is applied.

### 3.4 FLOORING INSTALLATION

- A. Install flooring after finishing operations, including painting, have been completed. Moisture content of concrete slabs, building air temperature, and relative humidity must be within limits recommended by flooring manufacturer's directions.

- B. Patch and repair floors and walls to receive flooring for proper installation of flooring, stair accessories, and base.
- C. Place flooring with adhesive cement in strict compliance with manufacturer's recommendations. Butt tightly to vertical surfaces and edgings. Scribe around obstructions and to produce neat joints, laid tight, even, and straight. Extend flooring into toe spaces.
- D. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent marking device.
- E. Install flooring on covers for telephone and electrical ducts and other such items as occur within finished floor areas.
- F. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.
- G. Tightly cement flooring to subbase without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.

### 3.5 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing resilient floor coverings:
  - 1. Remove adhesive and other surface blemishes using cleaner recommended by floor covering manufacturer.
  - 2. Sweep or vacuum floor thoroughly.
  - 3. Do not wash floor covering until after time period recommended by floor covering manufacturer.
    - a. Initial cleaning should only be performed 72 hours after the rubber athletic surface has been completely installed.
  - 4. Damp-mop floor to remove marks and soil.
- B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by manufacturer of resilient product involved.
- C. Initial cleaning should only be performed 72 hours after the rubber athletic surface has been completely installed.

- D. Clean products specified in this Section not more than four days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products using method recommended by manufacturer. Strip protective floor polish that was applied after completing installation, prior to cleaning.
- E. Do not move heavy and sharp objects directly over floor coverings. Place plywood or hardboard panels over floor coverings and under objects while they are being moved. Slide or roll objects over panels without moving panels.

### 3.6 FINISHING

- A. After completion of project and just prior to final inspection of work, thoroughly clean floors and accessories in accordance with Manufacturer's recommendations.

END OF SECTION 096566

## SECTION 096813 - TILE CARPETING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Carpet tile.

#### 1.2 SUBMITTALS

- A. Product Data: Submit product data for each carpet material and installation accessory required. Submit written data on physical characteristics, durability, resistance to fading, and flame resistance characteristics.

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. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

- E. Qualification Data: For Installer.

- F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

- G. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.
- H. Warranty: Special warranty specified in this Section.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
1. Flammability:
    - a. Methenamine Pill: Meets CGSB 4-GP-129/DOC FF-1-70
    - b. Radiant Panel: Class 1 (direct gluedown)
    - c. Smoke Density: ASTM E-662 less than 450.
- C. Preinstallation Conference: Conduct conference at Project site.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

### 1.5 PROJECT CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Comply with manufacturer's requirements for temperature and humidity.
- C. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- D. Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.



- E. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

## 1.6 WARRANTY

- A. 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, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
  - 3. Warranty Period: Minimum 10 years from date of Substantial Completion.

## 1.7 EXTRA MATERIALS

- A. At the time of building acceptance, deliver to the Owner the following extra materials. Deliver in original unopened cartons or containers with each item properly identified.
  - 1. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
    - a. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

## PART 2 - PRODUCTS

### 2.1 CARPET TILE

- A. Product and Manufacture – Basis of Design: Refer to the Finish Legend.

### 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. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- 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 and the following:
  - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
  - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
  - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI 104, Section "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations for carpet installation.
- B. Maintain dye lot integrity. Do not mix dye lots in same area.
- C. 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.
- D. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- E. 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.
- F. Install pattern parallel to walls and borders.
- G. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

### 3.4 CLEANING AND PROTECTION

- A. 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.
- B. Protect installed carpet tile to comply with CRI 104 "Protection of Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

## SECTION 099100 - PAINTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

##### A. Section Includes:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment installed and application of paint coats to all finish coated mechanical and electrical equipment in exterior locations, except as otherwise indicated.

- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

- D. Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

#### 1.2 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.
  - 1. After color selection, the Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
  - 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
  - 2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
  - 3. On actual wall surfaces and other exterior and interior building components, duplicate painted finishes of prepared samples. On at least 100 square feet of surface, as directed, provide full-coat finish samples until required sheen level, color and texture is obtained; simulate finished lighting conditions for review of in-place work.
- D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

### 1.3 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. VOC content.

- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## 1.5 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 degrees F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 degrees F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products and Manufacturers: Subject to compliance with requirements, products and manufacturers specified include, but are not limited to, the following:
  - 1. The Sherwin-Williams Company
  - 2. Glidden Professional
- B. Other Products and Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Benjamin Moore & Company (Moore)
  - 2. Glidden Professional
  - 3. PPG Industries, Inc. (PPG)

## 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
  - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Provide color selections made by the Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

### 3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.



### 3.6 INTERIOR PAINT SCHEDULE

#### A. Gypsum Drywall – Walls:

1. Paint System, Application and Finish: Latex; two Finish Coats over Primer.
  - a. Primer: Promar 200 Zero VOC Latex Primer
  - b. Finish Coats: Promar 200 Zero VOC Interior Latex
  - c. Sheen Level: Refer to the Finish Legend.

#### B. Gypsum Drywall – Ceilings:

1. Paint System, Application and Finish: Latex; two Finish Coats over Primer; refer to the Finish Identification list for gloss level (Finish).
  - a. Primer: Promar 200 Zero VOC Latex Primer
  - b. Finish Coats: Promar 200 Zero VOC Interior Latex
  - c. Sheen Level: Refer to the Finish Legend.

#### C. Concrete Masonry Units:

1. Paint System, Application and Finish: Latex; two Finish Coats over Primer.
  - a. Primer: PrepRite Block Filler
  - b. Finish Coats: Promar 200 Zero VOC Interior Latex
  - c. Sheen Level: Refer to the Finish Legend.

#### D. Ferrous Metal: Includes steel doors and frames, handrails and railings.

1. Paint System, Application and Finish:
  - a. Primer: Kem Kromik Universal Metal Primer
  - b. Finish Coats: ProIndustrial Urethane Alkyd Enamel
  - c. Sheen Level: Refer to the Finish Legend.

#### E. Epoxy Floor Paint:

1. Application:
  - a. Primer: ArmorSeal FloorPlex 7100 Primer
  - b. Top Coat: ArmorSeal FloorPlex 7100 Coating Water Based Epoxy

#### F. Concrete Floors (Sealer): Sealed concrete.

1. Type and Application: Acrylic, clear. Two coats over prepared substrate.
  - a. Finish Coats: Groundworks 3214, Water-Based Clear Acrylic Concrete Sealer; Glidden Professional

### 3.7 EXTERIOR PAINT SCHEDULE

#### A. Portland Cement Plaster (Stucco): Masonry Topcoat

1. Paint System, Application and Finish: Acrylic; provide two finish coats over primer.
  - a. Conditioner Coat: Loxon Block Surfacers
  - b. Finish Coats: Loxon XP Zero VOC A24 Series

#### B. Ferrous Metal – Primed and Unprimed:

1. Paint System, Application and Finish: Alkyd/Latex; two finish coats over prime coat; semi-gloss finish. Pre-primed requires top finish only; prime coat damaged surfaces.
  - a. Primer: Pro Industrial Pro-Cryl Universal Primer
  - b. Finish: Fast Clad HB Acrylic Semi-Gloss

#### C. Zinc Coated Metal, Primed and Unprimed:

1. Paint System, Application and Finish: Alkyd; two finish coats over prime coat; Gloss finish. Pre-primed requires top finish only; prime coat damaged surfaces.
  - a. Primer: Pro Industrial Pro-Cryl Universal Primer
  - b. Finish: Fast Clad HB Acrylic Semi-Gloss

END OF SECTION 099100

## SECTION 101419 - DIMENSIONAL LETTER SIGNAGE

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Cast dimensional characters.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

B. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Full-size Sample of dimensional character.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

F. Sample Warranty: For warranty.

### 1.3 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Deterioration of finishes beyond normal weathering.
  2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 DIMENSIONAL CHARACTERS

- A. Cast Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
1. Character Material: Cast aluminum.
  2. Character Height: As indicated.
  3. Thickness: Manufacturer's standard for size of character.
  4. Finishes:
    - a. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF or FEVE resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      - 1) Color and Gloss: As selected by Architect from manufacturer's full range.
  5. Mounting: Concealed studs.
  6. Typeface: As indicated.

### 2.2 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

## 2.3 ACCESSORIES

- A. Fasteners and Anchors: Types required for secure anchorage of signage to substrates indicated.
  - 1. Fasteners for Exterior Use: 300 Series stainless steel.

## 2.4 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
  - 1. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
  - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
  - 3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101419

## SECTION 102113 - TOILET COMPARTMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Toilet compartments and urinal screens.

#### 1.2 SUBMITTALS

- A. Product Data: For products indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Show locations of cutouts for compartment-mounted toilet accessories.
  - 2. Show locations of reinforcements for compartment-mounted grab bars.
  - 3. Show locations of centerlines of toilet fixtures.
- C. Samples for Initial Selection: For materials indicated. Include Samples of hardware and accessories involving material and color selection.
- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
  - 1. Panels: Material, color, and finish required for units, prepared on 6-inch- square Samples of same thickness and material indicated for Work.
- E. Product Certificates: For each type of toilet compartment, from manufacturer.
- F. Maintenance Data: For toilet compartments to include in maintenance manuals.

#### 1.3 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 75 or less.
  - 2. Smoke-Developed Index: 450 or less.

#### 1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- B. Stainless-Steel Castings: ASTM A 743.

#### 2.2 TOILET COMPARTMENTS AND URINAL SCREENS

- A. Manufacturer and Product – Basis of Design: METPAR Corp.
  - 1. Description: Floor mounted; stainless steel toilet enclosures; #4 finish.
  - 2. Style: FT-700E Dorian Style with Privacy Strips; floor mounted; 5-SM textured pattern.
- B. Toilet-Enclosure Style: As indicated.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Manufacturer's standard.
  - 1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
- E. Pilaster Sleeves (Caps): Manufacturer's standard design.
- F. Brackets: Stainless steel stirrup brackets.

#### 2.3 ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
  - 1. Material: Stainless steel.
  - 2. Hinges: Manufacturer's standard hinge.
  - 3. Latch and Keeper: Manufacturer's standard latch unit designed for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
  - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.



5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
  6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

## 2.4 FABRICATION

- A. General: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts.
- B. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.

### 3.2 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

## SECTION 102600 - WALL AND DOOR PROTECTION

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Wall protection.

#### 1.2 SUBMITTALS

- A. Product Data: Include construction details and material descriptions for each impact-resistant wall-protection unit.
- B. Shop Drawings: For each impact-resistant wall-protection unit showing locations and extent. Include sections, details, and attachments to other work.
- C. Samples for Verification: For each type of exposed finish required; samples of size indicated below.
1. Wall Guards: Manufacturer's standard samples.
- D. Material Test Reports: For impact-resistant wall protection.
- E. Maintenance Data: For impact-resistant wall-protection.

### PART 2 - PRODUCTS

#### 2.1 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. IPC Door and Wall Protection Systems, Division of InPro Corporation
  2. Material: Stainless-steel sheet, Type 304.
    - a. Thickness: Minimum 14 gauge.
    - b. Finish: Directional satin, No. 4.
    - c. Mounting: Screw-on; provide with 300 Series stainless steel fasteners.

## 2.2 BUMPER GUARDS

A. Description: Heavy-duty rubber wall guard.

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

a. IPC Door and Wall Protection Systems, Division of InPro Corporation

1) Product: D-Fender Rubber Wall Guards; provide with support plates.

a) Height: 4 inches.

b) Color: Black.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Install wall protection units in accordance with manufacturer's installation instructions and recommendations.

B. Immediately after completion of installation, clean wall protection units in accordance with manufacturer's instructions and recommendations.

C. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

## SECTION 102800 - TOILET AND BATH ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Toilet accessories.

#### 1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, and finishes for each accessory specified.
- B. Setting Drawings: For installing anchoring devices.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

#### 1.4 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.5 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 TOILET ACCESSORIES

- A. Products and Manufacturer – Refer to Accessories Schedule.

### 2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

### 2.3 FABRICATION

- A. General: Names or labels are not permitted on exposed faces of accessories. On interior surface not exposed to view or on back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.

## 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. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
- C. Remove temporary labels and protective coatings.
- D. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

## SECTION 102819- GLASS SHOWER DOOR ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section includes:
  - 1. Glass shower door assemblies.

#### 1.2 SUBMITTALS

- A. Product Data: Product data for products indicated.
  - 1. Include material finish selection information.
- B. Shop Drawings: Show layout of shower enclosures, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.
  - 1. Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

#### 1.3 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

### PART 2 - PRODUCTS

#### 2.1 GLASS SHOWER DOOR ASSEMBLIES

- A. Description: Glass shower doors.
  - 1. Style: As indicated.
  - 2. Dimensions: Field verify.
  - 3. Glass Panels: Comply with ANSI Z97.1; minimum 3/8-inch thick polished glass; fully tempered, clear, polished edge.
  - 4. Hinges: Stainless steel, satin finish; style to be selected by the Architect from manufacturer's full line.
  - 5. Handle: Stainless steel, satin finish; style to be selected by the Architect from manufacturer's full line.
  - 6. Metal Finish: Stainless steel, satin finish.
  - 7. Door Sweep: Clear acrylic; at bottom of shower door and lever side.

## 2.2 MISCELLANEOUS MATERIALS

- A. Installation Hardware: Provided stainless steel fasteners and anchors required for installation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install shower enclosure components in accordance with manufacturer's instructions and recommendations.
  - 1. Provide all hardware, fasteners, gaskets, sealants, and accessories for a complete installation.

### 3.2 CLEANING AND PROTECTION

- A. Clean glass, hardware, and framing in accordance with manufacturer's instructions and recommendations.
- B. Protect installed shower enclosures to prevent damage. Replace damaged units that cannot be repaired to the satisfaction of the Architect.

END OF SECTION 102819

## SECTION 104413 - FIRE EXTINGUISHER CABINETS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Fire extinguisher cabinets for the following:
    - a. Portable fire extinguishers.

#### 1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
  - 1. Fire Extinguisher Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguisher cabinets through one source from a single manufacturer.

#### 1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

### PART 2 - PRODUCTS

#### 2.1 FIRE EXTINGUISHER CABINETS

- A. Products and Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Architectural Series; Larsen's Manufacturing Company.



- B. Other Acceptable Manufacturers: Subject to compliance with requirements, available products and manufacturers that may be incorporated into the Work include, but are not limited to, the following:

1. JL Industries, Inc.
2. Potter Roemer; Div. of Smith Industries, Inc.

## 2.2 FABRICATION

- A. Cabinet Construction: Non-fire-rated and fire-rated cabinets; provide fire-rated cabinets where fire-rated construction is indicated.
- B. Semi-Recessed Cabinet: Cabinet semi-recessed in walls.
1. Edge Trim: 1-1/2-inch square trim.
- C. Cabinet Trim Material: Type 304 stainless steel sheet; #4 finish.
- D. Door Material: Type 304 stainless steel sheet; #4 finish.
- E. Box Material: Heavy duty gauge steel sheet; white baked enamel finish.
- F. Door Style: Vertical Duo panel with frame.
- G. Door Glazing: Clear 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.
1. Latch: Manufacturer's standard.
  2. Hinge: Concealed hinge permitting door to open 180 degrees.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire Extinguisher Cabinets: Fasten fire-protection cabinets to structure, square and plumb.

### 3.4 ADJUSTING AND CLEANING

- A. Adjust fire-protection cabinet doors to operate easily without binding.
- B. On completion of fire extinguisher cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- C. Replace fire extinguisher 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:

1. Portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Warranty: Sample of special warranty.
- C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

#### 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. Preinstallation Conference: Conduct conference at Project site.

#### 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 cabinets and mounting bracket indicated.
  - 1. Manufacturer – Basis of Design: Larsen's Manufacturing Company
  - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco Fire Protection Products
    - c. Badger Fire Protection; a Kidde company.
  - 3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. All Areas: UL-rated 4A-80B:C

### 2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red black baked-enamel finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install fire extinguishers and mounting brackets in accordance with manufacturer's instructions and recommendation, at locations indicated, and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

## SECTION 105143 - WIRE MESH STORAGE LOCKERS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Wire mesh storage lockers.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. American Wire Inc.
  - 2. California Wire Products Corporation.
  - 3. Kenco Wire & Iron Products Inc.

#### 2.2 MATERIALS

- A. Steel Wire: ASTM A 510.
- B. Steel Plates, Channels, Angles, and Bars: ASTM A 36.
- C. Steel Sheet: Cold-rolled steel sheet, ASTM A 1008, Commercial Steel (CS), Type B.
- D. Metallic-Coated Steel Sheet: ASTM A 653, Commercial Steel (CS), Type B, with G60 zinc (galvanized) or A60 zinc-iron-alloy (galvannealed) coating designation.
- E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer, complying with MPI#79.

## 2.3 WIRE MESH STORAGE LOCKERS

- A. Unit Sizes: As indicated on the Drawings.
- B. Mesh: 0.135-inch- diameter, intermediate-crimp steel wire woven into 1-by-2-inch rectangular mesh.
- C. Wall Panels: 1-1/4-by-1-1/4-by-1/8-inch steel angle framing on top, bottom, and back sides, and 3-by-1/8-inch cold-rolled steel flat bar framing on front side, with wire mesh welded to framing.
  - 1. Horizontal Panel Stiffeners: 1-1/4-by-1-1/4-by-1/8-inch steel angles or 3/4-by-1/4-inch hot-rolled steel flat bars.
- D. Backs: Fabricated from same mesh as wall panels.
- E. Doors: Fabricated from same mesh as wall panels, with framing fabricated from 1-1/4-by-1-1/4-by-1/8-inch steel angles on four sides with wire mesh welded to framing. Include padlock hasp.
  - 1. Horizontal Stiffeners for Single-Tier Doors: 3/4-by-1/4-inch steel flat bars.
  - 2. Hinges: Full-surface type, 2-1/2-by-2-1/2-inch steel, 1-1/2 pairs per single-tier door; bolted, riveted, or welded to door and jamb framing.

## 2.4 FABRICATION

- A. General: Fabricate wire mesh storage lockers from components of sizes not less than those indicated. Use larger size components as recommended by wire mesh manufacturer. Furnish bolts, hardware, and accessories required for complete installation with manufacturer's standard finishes.
  - 1. Fabricate wire mesh storage lockers to be readily disassembled.
  - 2. Welding: Weld corner joints of framing and grind smooth, leaving no evidence of joint.
- B. Wire Mesh Storage Lockers: Fabricate initial storage locker with front and two sides. Fabricate additional storage lockers as add-on units designed to share one side with initial storage locker.
  - 1. Fabricate wall panel and door framing with slotted holes for connecting adjacent panels.
  - 2. Prehang doors in factory.

## 2.5 STEEL AND IRON FINISHES

- A. Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard enamel or powder-coat finish, suitable for use indicated, with a minimum dry film thickness of 2 mils.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 WIRE MESH STORAGE LOCKERS ERECTION

- A. Anchor wire mesh storage lockers to floor with 3/8-inch- diameter expansion anchors at 12 inches o.c. through bottom panel framing. Shim panel framing as required to achieve level and plumb installation.
- B. Anchor wire mesh storage lockers to walls at 12 inches o.c. through back corner panel framing.
- C. Attach adjacent wire mesh storage lockers to each other through side panel framing.
- D. Install doors complete with door hardware.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust doors to operate smoothly and easily without binding or warping. Adjust hardware to function smoothly. Confirm that hasps engage accurately and securely without forcing or binding.
- B. 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.

END OF SECTION 105143

## SECTION 105500 - MAILBOXES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Mailboxes.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty.

B. Shop Drawings: For postal specialties.

1. Include plans, elevations, sections, and attachment details.
2. Include identification sequence for compartments.
3. Include layout of identification text.
4. Include setting drawings, templates, and installation instructions for anchor bolts and other anchorages installed as part of the Work of other Sections.

C. Samples for Verification: For exposed finish, prepared on 6-by-6-inch square Samples.

D. Product Certificates: For each type of postal specialty required to comply with USPS regulations, signed by product manufacturer. Include written approval by Postmaster General.

E. Sample Warranty: For warranty indicated.

F. Maintenance Data: For postal specialties and finishes to include in maintenance manuals.

#### 1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Key Blanks: 50 for each type of compartment-door lock installed.



#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Furnish lock keys according to USPS requirements; with temporary identification for their respective locks, bagged, and securely taped inside the collection compartment for shipping.

#### 1.5 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of postal specialties that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures.
    - b. Faulty operation of hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MAILBOXES - MAIL RECEPTACLES

- A. Front-Loading Mail Receptacles: Consisting of multiple compartments with fixed, solid compartment backs, enclosed within a recessed wall box. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging side-hinged master door to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-STD-4C.
  - 1. Product and Manufacturer – Basis of Design: 4C Custom Horizontal Mailbox Front Loading; Salsbury Industries.
    - a. Compartments: As indicated.
  - 2. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bommer Industries, Inc.
    - b. Postal Products Unlimited, Inc.
  - 3. Frames: Fabricated from extruded aluminum or aluminum sheet; ganged and nested units, with cardholder and blank cards for tenant's identification within each compartment.
  - 4. Concealed Components and Mounting Frames: Aluminum or steel sheet with manufacturer's standard finish.

5. Exposed Aluminum Finish: Finish surfaces exposed to view as follows:

- a. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.2 FABRICATION

- A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.
- B. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.
- C. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.
- D. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.
- E. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.
- F. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for roughing-in openings, clearances, and other conditions affecting performance of the Work.
- B. Examine walls and other adjacent construction for suitable conditions before installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install postal specialties level and plumb, according to manufacturer's written instructions.
  - 1. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer.
  - 2. Where aluminum contacts grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
  - 3. Final acceptance of postal specialties served by the USPS depends on compliance with USPS requirements.

### 3.3 FIELD QUALITY CONTROL

- A. Arrange for USPS personnel to examine and test postal specialties served by the USPS after they have been installed according to USPS regulations.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.
- C. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal-specialty manufacturer.
- D. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.
- E. On completion of postal-specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION 105500

## SECTION 105711 – CLOSET SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Closet system.

#### 1.2 SUBMITTALS

- A. Product Data: For closet storage system and components specified. Include details of construction and connections relative to materials, dimensions of individual components, accessories, and finishes.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain shelving components through one source from a single manufacturer.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with manufacturer's instructions and recommendations for delivery, storage, and handling and protection of shelving system components.

### PART 2 - PRODUCTS

#### 2.1 CLOSET SYSTEM

A. Manufacturer – Basis of Design: Gravita

1. Series: Tubular
2. Color: White.
3. Configuration: As indicated.
4. Mounting Hardware: Provide hardware and accessories required for shelving installation to substrates indicated. Provide support brackets where required for spans indicated.
  - a. Provide wall clips, support brackets, shelf supports, and anchors required for a complete installation.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of shelving.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Comply with closet storage shelving manufacturer's written installation instructions.
- B. Install shelving level, plumb, square, and true.
- C. Anchor system to substrate construction by method recommended by the manufacturer.

END OF SECTION 105711

## SECTION 111200 - PARKING CONTROL EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Traffic gates.
2. Vehicle detectors.

#### 1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 SUBMITTALS

A. Product Data: For products indicated.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for parking control equipment.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties.

B. Shop Drawings: For parking control equipment.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Vehicle Detectors: Layout and method of placement of vehicle loop detector system.

C. Qualification Data: For Installer.

D. Field quality-control reports.

E. Operation and Maintenance Data: For parking control equipment to include in emergency, operation, and maintenance manuals.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Gate Arms: Two breakaway gate arms for each gate installed, complete with accessory components.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain parking control equipment from single source from single manufacturer.

#### 2.2 SYSTEM DESCRIPTION

- A. Parking Control System: For the following types of parking management:
  - 1. Valet Parking: Card reader access entering and exiting.
- B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 2.3 TRAFFIC GATES

- A. General: Provide parking control device consisting of operator and controller housed in a weathertight, tamper-resistant cabinet enclosure with gate arm. Device shall be activated by a signal from access control device. Fabricate unit with gate-arm height in down position of not more than 35 inches above pavement.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amtel Security System Inc.
    - b. Delta Scientific Corp.
    - c. Federal APD, Inc.
- B. Standards: ASTM F 2200 for barrier gates and gate operators that are listed and labeled according to UL 325 by a qualified testing agency.

- C. Controller: Factory-sealed, solid-state, plug-in type, with galvanized-steel box for wiring connections.
1. Type: Non-communicating.
    - a. Capable of logic for one- and two-way lanes.
    - b. Separate momentary contacts for vehicle entries and vehicle exits.
  2. Physical Characteristics:
    - a. On-off power supply switch.
    - b. Automatic-manual switch.
    - c. Differential counter.
    - d. Communication port.
    - e. Internal resettable counters.
    - f. Thermal-overload protection with manual reset.
    - g. Plug-in connectors for two vehicle loop detectors.
    - h. Thermostatically controlled heater with on/off/auto switch.
    - i. Switch to test motor and limit switches.
    - j. Emergency manual disconnect.
    - k. Battery backup.
    - l. Single, 115-V ac grounded power receptacle.
  3. Operational Characteristics:
    - a. Able to store successive inputs and sequentially processing each one.
    - b. Automatic instant-reversing obstacle detector mechanism that stops downward motion of gate arm if arm contacts or nears an object and that immediately returns arm to upward position. Include a zero- to 60-second, variable-time reset device.
    - c. Directional arming logic.
    - d. Broken gate-arm monitoring.
    - e. Programmable automatic timer.
    - f. Diagnostic mode for on-site testing, with LEDs for inputs and outputs.
    - g. Automatic and continuous testing of inputs and outputs.
    - h. Reversible arm capability for right- or left-handed operation.
- D. Cabinets: Fabricated from sheet metal with seams welded and ground smooth; approximately 15 inches square by 40 inches tall. Provide single, gasketed access door for each cabinet with flush-mounted locks. Furnish two keys for each lock, all locks keyed alike. Fabricate cabinet with internal reinforcing and four mounting holes accessible only from inside cabinet.
1. Stainless-Steel Sheet: Not less than 0.109-inch- thick, stainless-steel sheet.
    - a. Finish cabinet exterior with No. 4 finish.



- E. Straight Gate Arm: 1-by-4-inch nominal- size pine or redwood, with painted finish and black diagonal stripes on traffic-side face. Provide mounting flange with breakaway feature to ensure a clean break if arm is struck by vehicle.
  - 1. Length: As indicated on Drawings.
- F. Operator: UL labeled and listed, 60-Hz, single-phase, instant-reversing, continuous-duty motor for operating gate arm. Transmit power to gate-arm drive shaft through the speed reducer to harmonic-acting crank and connecting rod. Fabricate crank, rod, and drive shaft of galvanized solid bar steel. Provide an operable cam for adjusting arm travel.
  - 1. Opening Time: Adjustable.
  - 2. Inherently adjustable, torque limiting clutch for safety.
- G. Characteristics:
  - 1. Audible alarm that activates as part of a safety device system.
  - 2. Additional obstruction detector; noncontact infrared.
  - 3. Barrier-arm warning safety signs on both sides of unit to limit traffic to vehicular traffic.
  - 4. Low-voltage light on cabinet top that flashes or changes from red to green when barrier gate is operating.
  - 5. Manually operated crank for emergency operation.

## 2.4 VEHICLE DETECTORS

- A. General: Provide detection devices that sense presence or transit of vehicles and emit signals activating gate-arm operators.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amtel Security System Inc.
    - b. Delta Scientific Corp.
    - c. Federal APD, Inc.
- B. Vehicle Loop Detector System: Self-tuning electronic presence detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light. Include automatic closing timer with adjustable time delay before closing, timer cut-off switch, designed to hold gate arm open until traffic clears. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location indicated on Drawings, as recommended in writing by detection system manufacturer for pave-over or saw-cut installation.
  - 1. Factory-Formed Loop: Wire, preformed in size indicated.

2. Operation:

- a. Recognize vehicles within 6 inches of each other on standard-sized loop.
- b. Recognize vehicle direction by detecting vehicle moving from one loop to another.
- c. Generate reverse count if vehicle backs up after generating directional count in forward direction.
- d. Continuous diagnostic monitoring for intermittently operating and failed loops.
- e. Crosstalk test between adjacent loops.

2.5 ANCHORAGES

- A. Anchor bolts; hot-dip galvanized according to ASTM A 153/A 153M and ASTM F 2329.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, including equipment bases; accurate placement, pattern, and orientation of anchor bolts; critical dimensions; and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical and communication systems to verify actual locations of connections before parking control equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Excavation for Traffic Controllers: Saw cut existing pavement for recessed traffic controllers and hand-excavate recesses to dimensions and depths and at locations as required by traffic controller manufacturer's written instructions and as indicated on Drawings.

3.3 INSTALLATION

- A. General: Install parking control equipment as required for complete and integrated installation.
  - 1. Rough-in electrical connections.

- B. Gates: Anchor cabinets to concrete bases with anchor bolts or expansion anchors, and mount barrier gate arms.
  - 1. Install barrier gates according to UL 325.
- C. Vehicle Loop Detectors: Cut grooves in pavement and bury or bury and seal wire loop at locations indicated on Drawings according to manufacturer's written instructions. Connect to parking control equipment operated by detector.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Parking control equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.5 ADJUSTING

- A. Adjust parking control equipment to function smoothly, and lubricate as recommended by manufacturer.
- B. Confirm that locks engage accurately and securely without forcing or binding.
- C. After completing installation of exposed, factory-finished parking control equipment, inspect exposed finishes and repair damaged finishes.

### 3.6 PROTECTION

- A. Remove barrier gate arms during the construction period to prevent damage, and install them immediately before Substantial Completion.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain parking control equipment.

END OF SECTION 111200

## SECTION 113100 - RESIDENTIAL APPLIANCES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Appliances.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, dimensions, furnished accessories, and finishes for each appliance.
- B. Product Schedule: For appliances. Use same designations indicated on Drawings.
- C. Product Certificates: For each type of appliance, from manufacturer.
- D. Field quality-control reports.
- E. Warranties: Sample of special warranties.
- F. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer for installation and maintenance of units required for this Project.
- B. Regulatory Requirements: Comply with the following:
  1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. ANSI: Provide gas-burning appliances that comply with ANSI Z21 Series standards.

#### 1.4 WARRANTY

- A. Manufacturer's Warranties: Manufacturer's standard form in which manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Minimum two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 APPLIANCES

#### A. Microwave – Over-the-Range:

1. Model and Manufacturer: GE Profile Series Advantium 240 Over-the-Range Oven, Model PSA9240SFSS; General Electric Company (GE)
  - a. Electrical Requirements: 120V; 60 Hz

#### B. Range:

1. Model and Manufacturer: GE Café Series 30" Free Standing Radiant Range with Baking Drawer, Model CS980STSS; General Electric Company (GE)
  - a. Electrical Requirements: 208/240V; 60 Hz

#### C. Range Hood:

1. Model and Manufacturer: GE Café Series 36" Commercial Hood, Model CV966TSS; General Electric Company (GE)
  - a. Electrical Requirements: 115V; 60 Hz; 15 Amps

#### D. Refrigerator:

1. Model and Manufacturer: GE Café Series ENERGY STAR French-Door Ice & Water Refrigerator, Model CFE29TSDSS; General Electric Company (GE)
  - a. Electrical Requirements: 115V; 60 Hz; 15 Amps

#### E. Dishwasher:

1. Model and Manufacturer: GE Café Series Stainless Steel Interior Built-In Dishwasher with Hidden Controls, Model CDT765SSFSS; General Electric Company (GE)
  - a. Electrical Requirements: 115V; 60 Hz; 15 Amps

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

- C. Examine walls, ceilings, and roofs for suitable conditions where appliances will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written instructions.
- B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.
- C. Utilities: Comply with plumbing and electrical requirements.

### 3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
  - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After installation, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

END OF SECTION 113100

## SECTION 118226 - WASTE COMPACTORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Waste compactors

#### 1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.3 SUBMITTALS

A. Product Data: For compactor indicated.

1. Include rated capacities, operating characteristics, furnished specialties and accessories, and finishes.

B. Shop Drawings: For each waste compactor and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and attachment details.
2. Indicate equipment access points and required space for equipment service and operation.
3. Include setting drawings, templates, and instructions for installing anchor bolts and other anchorages.
4. Include diagrams for power, signal, and control wiring.

C. Field quality-control reports.

D. Operation and Maintenance Data: For waste compactors to include in operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 WASTE COMPACTORS

A. Model and Manufacturer: IHR-50SF Standard High Rise Compactor; WasteCare Corporation, Gainesville, GA

1. Waste-Compactor Standards: ANSI Z245.21 including appendices and NFPA 82.
2. Electrical Characteristics:



- a. Voltage: 208 V, single phase, 60 hertz.
- 3. Controls: Manufacturer's standard.
- 4. Finish: Manufacturer's standard.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, clearances, service rough-ins, and other conditions affecting performance of the Work.
- B. Examine walls, floors, and chutes for suitable conditions where each waste compactor will be installed.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install each waste compactor according to manufacturer's written instructions, ANSI Z245.2, and ANSI Z245.21, including appendices.

### 3.3 FIELD QUALITY CONTROL

- A. General: Perform tests as follows:
  - 1. Perform installation and startup checks according to ANSI Z245.21, Appendix D, "Tests for Evaluation of Equipment and Performance," and manufacturer's written instructions.
  - 2. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Verify correct locations, color coding, and legibility of caution, warning, and danger markings.
  - 4. Certify compliance with test parameters.
- B. A waste compactor will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain waste compactors according to manufacturer's written instructions and ANSI Z245.2.

END OF SECTION 118226

## SECTION 123530 - MANUFACTURED CASEWORK

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Indoor kitchen cabinets.
  2. Outdoor kitchen cabinets.
  3. Countertops.

#### 1.2 SUBMITTALS

- A. Product Data: For the following:
1. Cabinets.
  2. Cabinet hardware.
  3. Countertops.
- B. Shop Drawings: Include plans, elevations, details, and attachments to other work. Show materials, finishes, filler panels, and hardware.
- C. Samples for Initial Selection: For cabinet finishes and countertop material.
- D. Samples for Verification: 8-by-10-inch Samples for each finish material including countertops.

#### 1.3 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and dry, and temporary HVAC system is operating and maintaining temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

#### 1.4 COORDINATION

- A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

## PART 2 - PRODUCTS

### 2.1 CABINETS

- A. Manufacturer – Basis of Design: Refer to the Finish Legend.
- B. Face Style: As indicated.
- C. Cabinet Style: As indicated.
- D. Door and Drawer Fronts: To be selected by the Architect from manufacturer's full line.
- E. Shelves: Manufacturer's standard.
- F. Joinery: Manufacturer's standard.
- G. Factory Finishing: Finish cabinets at factory. Defer only final touchup until after installation.

### 2.2 CABINET MATERIALS – INTERIOR CABINETS

- A. Exposed Materials:
  - 1. Exposed Wood Species: To be selected by the Architect from manufacturer's full line.
  - 2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
  - 3. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
  - 4. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
    - a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.
- B. Semiexposed Materials: Unless otherwise indicated, provide the following:
  - 1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces.
  - 2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces.
  - 3. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
    - a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

- 4. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper.

- a. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

- C. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

- D. Adhesives: Adhesives shall not contain urea formaldehyde.

## 2.3 CABINET MATERIALS – EXTERIOR CABINETS

- A. Exposed Materials: Manufacturer's standard.

- 1. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

- B. Semiexposed Materials: Manufacturer's standard.

- 1. Colors, Textures, and Patterns: As selected by Architect from cabinet manufacturer's full range.

- C. Concealed Materials: Manufacturer's standard.

## 2.4 COUNTERTOPS

- A. Material: To be selected by the Architect from manufacturer's full line.

- B. Configuration: As indicated.

- C. Fabrication: Manufacturer's standard for countertop types required.

- D. Adhesives: Adhesives shall not contain urea formaldehyde.

## 2.5 CABINET HARDWARE

- A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

- B. Pulls: Back-mounted decorative pulls.

- C. Hinges: Manufacturer's standard.

- D. Drawer Guides: Manufacturer's standard; self-closing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install cabinets with no variations in flushness of adjoining surfaces; use concealed shims. Where cabinets abut other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match cabinet face.
- B. Install cabinets without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.
- C. Install cabinets level and plumb to a tolerance of 1/8 inch in 8 feet.
- D. Fasten cabinets to adjacent units and to backing.

### 3.3 ADJUSTING AND CLEANING

- A. Adjust cabinets and hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.
- B. Clean casework on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION 123530

## SECTION 123661 – SIMULATED STONE COUNTERTOPS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Simulated stone countertops.

#### 1.2 SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Verification: For the following products:
  - 1. Countertop material, 6 inches square.

#### 1.3 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements before countertop fabrication is complete.

### PART 2 - PRODUCTS

#### 2.1 COUNTERTOPS

- A. Product and Manufacturer – Basis of Design: Zodiaq quartz surfaces; DuPont
  - 1. Material: Homogeneous quartz surfaces material.
  - 2. Thickness: As indicated.
  - 3. Edge Treatment: As indicated.
  - 4. Configuration: As indicated.
  - 5. Color: To be selected by the Architect from manufacturer's full line.
- B. Fabrication: Fabricate tops in one piece, unless otherwise indicated. Comply with material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- C. Joint Adhesives: Types recommended by the manufacturer for applications indicated. Adhesives shall not contain urea formaldehyde.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions and recommendations.
- B. Install countertops level to a tolerance of 1/8 inch in 8 feet.
- C. Fasten countertops securely to base cabinet. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- D. Clean surfaces in accordance with manufacturer's instructions and recommendations.
- E. Protect surfaces from damage throughout remainder of construction operations.
- F. Replace damaged work to the satisfaction of the Architect.

END OF SECTION 123661



## SECTION 142100 - ELEVATORS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Elevators.

#### 1.2 SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
- B. Shop drawings:
1. Show equipment arrangement in the controller closet, corridor, pit and hoistway. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
  2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
  3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
  4. Indicate electrical power requirements and branch circuit protection device recommendations.
- C. Samples: For exposed finishes of cars, hoistway doors and frames, and signal equipment; 3-inch- square samples of sheet materials; and 4-inch lengths of running trim members.
- D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, including emergency generator, as shown and specified, are adequate for elevator system being provided.
- E. Maintenance Manuals: Include operation and maintenance instructions, parts listing with sources indicated, recommended parts inventory listing, emergency instructions, and similar information. Include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel. Submit for Owner's information at Project closeout as specified in Division 1.
- F. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.
- B. Regulatory Requirements: In addition to local governing regulations, comply with applicable provisions in ASME A17.1, "Safety Code for Elevators and Escalators."
- C. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, UL10 (b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory.
- D. Accessibility Requirements: In addition to local governing regulations, comply with the Code.

### 1.4 COORDINATION

- A. Coordinate installation of items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work relating to elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

### 1.5 WARRANTY

- A. Manufacturer's Warranty: Written warranty, signed by manufacturer agreeing to repair, restore, or replace defective elevator work within specified warranty period.
  - 1. Warranty Period: 12 months from date of Substantial Completion.

### 1.6 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 12 months for each elevator during normal working hours excluding callbacks from date of Substantial Completion.
  - 1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
  - 2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.

3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

## 1.7 PROJECT CONDITIONS

### A. Temporary Use:

1. Provide all necessary protection to prevent damage to each elevator used for construction purposes before Substantial Completion.
2. Provide temporary enclosures, coverings, guards, barriers and other devices required to protect the elevator car enclosures, hoistway entrances, signal fixtures and related materials, components and finishes from damage. Protective materials, methods and procedures shall be approved by the elevator manufacturer and paid for by the user.
3. Maintenance during use, including cleaning, lubricating and adjusting equipment and components for proper elevator operation shall be performed only by the elevator manufacturer. Cost for maintenance shall be paid by the user.
4. Elevators shall be free of damage or deterioration at time of Substantial Completion. Cost to repair damaged materials and finishes and replace worn or defective components to restore elevators to their original condition shall be paid by the user.

## PART 2 - PRODUCTS

### 2.1 ELEVATORS

#### A. Manufacturer – Basis of Design: Otis Elevator Company

1. Elevator Type: Traction.
2. Rated Capacity: 3500 lbs.
3. Rated Speed: 350 ft/min.
4. Operation System: Manufacturer's standard.
5. Landings: As indicated
6. Openings: As indicated.
7. Clear Car Inside: As indicated.
8. Cab Height: As indicated.
9. Door Type: As indicated.
10. Power Characteristics: 480 volts, 3 Phase, 60 Hz.
11. Pit Depth: As indicated.
12. Button & Fixture Style: Vandal Resistant Signal Fixtures; refer to the Finish Legend.
13. Special Operations: None

## 2.2 MATERIALS, SYSTEMS AND COMPONENTS

- A. General: Provide manufacturer's standard elevator systems. Where components are not otherwise indicated, provide standard components, published by manufacturer as included in standard pre-engineered elevator systems and as required for a complete system.

## 2.3 ELEVATOR CAR ENCLOSURES

- A. Car Enclosure:
1. Walls: Refer to the Finish Legend.
  2. Ceiling: Refer to the Finish Legend.
  3. Flooring: Refer to the Finish Legend.
  4. Cab Fronts, Return Transom, Soffit and Strike: Provide panels faced with brushed stainless steel.
  5. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
    - a. Door Finish: Stainless steel panels: No. 4 brushed finish.
    - b. Cab Sills: Extruded aluminum, mill finish.
  6. Handrail: Refer to the Finish Legend.
  7. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
- B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station will give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

## 2.4 DOOR OPERATION

- A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
  2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
  3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel will reverse and the door will reopen to answer the other call.
  4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer will sound. When the obstruction is removed, the door will begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors will stop and resume closing only after the obstruction has been removed.
  5. Limited Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors will reverse and reopen partially. After the obstruction is cleared, the doors will begin to close.
  6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors will recycle closed then attempt to open six times to try and correct the fault.
  7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors will recycle open then attempt to close six times to try and correct the fault.
  8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.
- B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

## 2.5 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Swing return shall have a brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.
- B. Emergency Communications System: Integral phone system provided.

- C. Auxiliary Operating Panel: Not Required
- D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.
- E. Special Equipment: Not Applicable

## 2.6 CONTROL SYSTEMS

- A. Controller: Single unit installed in controller closet. The elevator control system shall be microprocessor based and software oriented. The system shall operate in real time, continuously analyzing the car(s) changing position, condition, and work load. All controller and operational circuits including the brake control and drive system shall be digital. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
  - 1. Momentary pressing of one or more buttons shall dispatch the car to the designated landings in the order in which the landings are reached by the car, irrespective of the sequence in which the buttons are pressed. Each landing call shall be canceled when answered.
  - 2. When the car is traveling in the up direction, it shall stop at all floors for which car buttons or "up" hall buttons have been pressed. The car shall not stop at floors where "down" buttons have been pressed, unless the stop for that floor has been registered by a car button or unless the down call is at the highest floor for which any buttons have been pressed. Pressing the "up" button when the car is traveling in the down direction shall not intercept the travel unless the stop for that floor has been registered by a car button or unless the up call is the lowest for which any button has been pressed.
  - 3. When the car has responded to its highest or lowest stop, and stops are registered for the opposite direction, its direction of travel shall reverse automatically and it shall then answer the calls registered for that direction. If both up and down calls are registered at an intermediate floor, only the call corresponding to the direction of car travel shall be canceled upon the stopping of the car at the landing.
  - 4. A car that is stopping for the last hall call in the preference direction and that hall call is for the opposite direction with no onward car calls, shall reverse preference when the selector position advances to the landing at which the car is committed to stop. A car that is stopping for the last hall call in the preference direction, and that hall call is for the same direction, shall hold its preference until the door is almost closed allowing time for a passenger to register an onward car call which will maintain the preference. If no car call is registered before the door is almost closed, the car will lose its preference and shall be available to accept calls in either direction.

- B. Operation: Selective Collective – ETA based. The system is optimized to get a car to the floor where a hall call has been registered, in the shortest time. The system receives input information from standard call pushbuttons located in the hall, car position and car load information from individual car Loadweighers. When group operation is required, the group supervisory operation shall be embedded within selected car controllers. No separate group controller shall be supplied. The microprocessor shall constantly scan the system for hall calls. When hall calls are registered, the control system shall immediately calculate the estimated time for arrival using such information as, number of floors to travel from the current position, the time it takes to travel one floor at top speed, calls assigned to a car, and car reversal time to respond to a call in the opposite direction of travel. When a car's status changes or additional hall calls are registered, the estimated time of arrival shall be recalculated and calls reassigned if necessary.
1. Traffic Pattern: The microprocessor shall provide flexibility to meet well defined patterns of traffic, including up peak, down peak, and heavy interfloor demands, and adjust for indeterminate variations in these patterns which occur in buildings.
  2. Artificial Intelligence: Artificial Intelligence shall be an integral part of the group control system software. The enhanced artificial intelligence will optimize the interfloor traffic performance. Inputs for the artificial intelligence shall include accurate passenger load from an electronic loadweigher, probable car calls generated from each hall call, type of building and observed traffic patterns.
- C. Load Weighing Device: Provide a load weighing device on each car which, when the particular car is filled to an adjustable percentage of the capacity load, shall cause the car to bypass landing calls but not car calls. The passed landing calls shall remain registered for the next following car.
1. The device shall be unaffected by the action of compensating chain or rope. The device shall detect a 50 pound (23 Kg.) load change under all conditions.
  2. The load sensor shall use a strain gauges attached to the ropes to accurately measure the weight in the car. The information shall be transferred via a serial link to the elevator controller.
- D. Anti-Nuisance Call Control: The microprocessor control system shall evaluate the number of people on the car and compare that value to the number of car calls registered. If the number of car calls exceeds the number of people by a field programmable value, the car calls shall be canceled after the first call has been answered.
- E. Position Selector: The position selector shall be part of the microprocessor system. The car position in the hoistway shall be digitized through a primary position encoder. The microprocessor control system shall store the floor position and slow down points in memory.

- F. Motion Control: The drive control system shall be dual-loop feedback system based primarily on car position. The velocity profile shall be calculated by the microprocessor control system producing extremely smooth and accurate stops. The velocity encoder shall permit continuous comparison of machine speed to velocity profile and to actual car speed. This accurate position/velocity feedback shall permit a fast and accurate control of acceleration and retardation.
- G. Motor Pre-Torque: Current shall be applied to the elevator drive before the brake is released and the speed pattern is dictated to eliminate roll back and sling shot effects of unbalanced loads in the car. The electronic load-weigher shall determine the load on the car determining a pre-torque reference to send to the drive.
- H. Emergency Power Operation: (Group 10-D4A) Upon loss of normal power, building-supplied standby power is available to the elevator on the same wires as the normal power. Once the loss of normal power has been detected and standby power is available, one elevator at a time from each group will be lowered to a pre-designated landing and will open the doors. After passengers have exited the elevator, the doors are closed and the car shuts down. The next available car in the group will then be selected to lower, allow passengers to exit, close the doors and shutdown. This process is repeated until all cars in the group have been lowered and parked. At this time, an elevator is automatically allowed to continue service using the building-supplied standby power. A manual selection switch is available to override the automatic selection and allow a car in the group to provide service to the building. When normal power is restored, the elevators automatically resume operation.
- I. Destination Dispatch: Not Applicable
- J. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- K. Special Operation: Not Applicable

## 2.7 HALL STATIONS

- A. Hall Stations, General: Vandal resistant buttons with center jewels which illuminate to indicate that a call has been registered at that floor for the indicated direction. Each button shall be provided with an internal automatic stop to prevent damage of switches that register the call. Provide 1 set of pushbutton risers. All fixtures shall be vandal resistant type. Provide one pushbutton riser with faceplates having a brushed stainless steel finish.
  - 1. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.



- C. Hall Position Indicator: An electronic dot matrix position indicator shall be provided and mounted for optimum viewing. As the car travels, its position in the hoistway shall be indicated by the illumination of the alphanumeric character corresponding to the landing which the elevator is stopped or passing. When hall lanterns are provided, the position indicator shall be combined with the hall lanterns in the same faceplate. Faceplates shall match hall stations. Provide at main landing only.
- D. Hall lanterns: Not Applicable
- E. Special Equipment: Not Applicable

## 2.8 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
  - 1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates, sight guards, and necessary hardware.
  - 2. Door and frame finish: Stainless steel panels, no. 4 brushed finish.
- B. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
  - 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
  - 2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
  - 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- D. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions, and examine supporting structure and other conditions under which elevator work is to be installed. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance.

### 3.2 INSTALLATION

- A. General: Install elevators in accordance with manufacturer's requirements.
  - 1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
  - 2. Comply with the National Electrical Code for electrical work required during installation.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels to ensure dimensional coordination of the work.
- D. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.
- E. Lubricate operating parts of systems as recommended by manufacturers.
- F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and direction of travel.
- H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- I. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

### 3.3 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 governing regulations and agencies.

- B. Operating Test: Load elevators to rated capacity and operate continuously for 30 minutes over full travel distance, stopping at each level and proceeding immediately to the next. Record temperature rise of elevator machines during 30-minute test period. Record failure of elevators to perform as required.
  - 1. Perform operating test specified above on one elevator of each type, capacity, speed, and travel distance.
- C. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

### 3.4 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.
- B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.

### 3.5 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies. Train Owner's personnel in procedures to follow in identifying sources of operational failures or malfunctions. Confer with Owner on requirements for a complete elevator maintenance program.
- B. Make a final check of each elevator operation with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

### 3.6 PROTECTION

- A. Temporary Use: Do not use elevators for construction purposes unless cars are provided with temporary enclosures, either within finished cars or in place of finished cars, to protect finishes from damage.
  - 1. Provide full maintenance service by skilled, competent employees of elevator Installer for elevators used for construction purposes. Include 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. Use same parts and supplies as used in the manufacture and installation of original equipment.

2. Provide protective coverings, barriers, devices, signs, and other procedures to protect elevators. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so that no evidence remains of correction work. 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.

END OF SECTION 142100

## SECTION 144111 - POOL LIFTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Pool lifts.

#### 1.2 SUBMITTALS

A. Product Data: For products indicated.

1. Include construction details, material descriptions, dimensions of individual components, and finishes for lifts.
2. Include rated capacities, operating characteristics, electrical characteristics, safety features, controls, finishes, and accessories.

B. Shop Drawings: For lift.

1. Include plans, elevations, sections, details, attachments to other work, and required clearances.
2. Indicate dimensions and weights.
3. Include details of equipment assembly and components.

C. Sample Warranty: For warranty indicated.

D. Operation and Maintenance Data: For lift.

1. In addition include the following:
  - a. Parts list with sources indicated.
  - b. Recommended parts inventory list.

#### 1.3 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of lifts that fail in materials or workmanship within specified warranty period.

1. Warranty Period:
  - a. Unit Warranty: Minimum one year from date of Substantial Completion.
  - b. Electronics Warranty: Manufacturer's standard five year warranty.
  - c. Structural Warranty: Manufacturer's standard lifetime warranty.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with applicable provisions of the Florida Building Code and the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- B. Regulatory Requirements: Comply with ASME A18.1, "Safety Standard for Platform Lifts and Stairway Chairlifts."

### 2.2 POOL LIFTS

- A. Product and Manufacturer: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Portable Pro Lift (F-004PPPB ); Aqua Creek Products, Missoula, MT
    - a. Lifting Capacity: 400 pounds.
    - b. Control: Two-button remote control.
    - c. Battery: Rechargeable type.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with manufacturer's written instructions for installation.
- B. Test safety devices and verify smoothness of required protective enclosures and other surfaces.

### 3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing: Test unit in accordance with manufacturer's instructions and recommendations and authorities having jurisdiction.

### 3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lifts. Include a review of emergency systems and emergency procedures to be followed at time of operational failure and other relative emergencies

- B. Check operation of lifts with Owner's personnel present and before date of Substantial Completion. Determine that operating systems and devices are functioning properly.

END OF SECTION 144111

## SECTION 144200 - WHEELCHAIR LIFTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Vertical platform lifts.

#### 1.2 SUBMITTALS

A. Product Data: For lift.

B. Shop Drawings: For lift.

1. Include plans, elevations, sections, details, attachments to other work, and required clearances.
2. Indicate dimensions, weights, loads, and points of load to building structure.
3. Include diagrams for power, signal, and control wiring.

C. Samples: For exposed finishes.

D. Sample Warranty: For lift.

E. Operation and Maintenance Data: For lift.

F. Inspection and Acceptance Certificates and Operating Permits: For lift.

#### 1.3 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

#### 1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of lifts that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.



## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.
- B. Regulatory Requirements: Comply with ASME A18.1, "Safety Standard for Platform Lifts and Stairway Chairlifts."

### 2.2 VERTICAL PLATFORM LIFT

- A. Vertical Platform Lift, General: Preengineered lift system.
  - 1. Model and Manufacturer – Basis of Design: Genesis OPAL; Garaventa Accessibility
    - a. Lift Height: As indicated.
  - 2. Other Acceptable Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Inclinator Company of America
    - b. National Wheel-O-Vator Co., Inc. (The)
- B. Platform Size: Manufacturer's standard.
- C. Platform Configuration: To suit application indicated.
- D. Rated Capacity: 750 lbs.
- E. Rated Speed: 10 fpm.
- F. Motor Horsepower: Manufacturer's standard for lift required.
- G. Power Supply: 120 V, 60 Hz, one phase.
- H. Emergency Operation: Provide manual operation and battery power system to raise or lower unit in case of malfunction or power loss.
- I. Self-Supporting Unit: Support vertical loads of unit only at base, with lateral support only at landing levels.
- J. Platform: Steel sheet or galvanized-steel sheet with manufacturer's standard black rubber flooring.

- K. Ramp: Retractable ramp matching platform to provide transition from lower floor to lift platform. Ramp lowers to floor automatically when lifts reach lower landing and door opens. Ramp rises automatically when lift control is activated for lift to leave lower landing.
1. Ramp Size: Manufacturer's standard for unit indicated; length as required for slope.
  2. Ramp Slope: Maximum 1:12.
  3. Ramp Finish: Finish ramps to match lift platform.

## 2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36.
- B. Steel Tubing: ASTM A 500.
- C. Steel Pipe: ASTM A 53; standard weight (Schedule 40) unless otherwise indicated or required by loads.
- D. Steel Sheet: ASTM A 1008, cold-rolled commercial steel (CS) or ASTM A 1011 hot-rolled, commercial steel (CS); as required for each use.
- E. Galvanized-Steel Sheet: ASTM A 653, G90 zinc coating,
- F. Galvanizing: Hot-dip galvanize items complying with the following:
1. ASTM A 123, for galvanizing steel and iron products.
  2. ASTM A 153, for galvanizing steel and iron hardware.
- G. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; manufacturer's standard strengths and thicknesses for type of use.
1. Extruded Aluminum: ASTM B 221.
  2. Aluminum Sheet and Plate: ASTM B 209.
- H. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- I. Stainless-Steel Tubing: ASTM A 554, Grade MT-304.
- J. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240 or ASTM A 666, Type 304.
- K. Stainless-Steel Floor Plate: ASTM A 793.
- L. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing structural members, guide rails, machines, and other lift components where installation of devices is specified in another Section.

- M. Expansion Anchors: Anchor-bolt-and-sleeve assembly of material indicated below with capability to sustain a load equal to 10 times the load imposed as determined by testing according to ASTM E 488 conducted by a qualified independent testing agency.

1. Material: Group 1, Alloy 304 or Alloy 316, stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594.

## 2.4 FINISHES

- A. Steel and Galvanized-Steel Factory Finish: Manufacturer's standard baked-enamel or powder-coat finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Comply with ASME A18.1 and manufacturer's written instructions for installation of lifts unless otherwise indicated.
- B. Minimum Headroom Clearance: Verify that installed lift will have a minimum headroom of 80 inches above any point on platform floor at any point of travel.
- C. Wiring Method: Conceal conductors and cables within housings of units or building construction. Do not install conduit exposed to view in finished spaces.
- D. Coordinate runway doors with platform travel and positioning, for accurate alignment and minimum clearance between platforms, runway doors, sills, and door frames.
- E. Position sills accurately and fill space under sills solidly with nonshrink, nonmetallic grout.
- F. Coordinate platform doors with platform travel and positioning.
- G. Adjust stops for accurate stopping at each landing.
- H. Adjust retractable ramps to meet maximum allowable slope and change-in-elevation requirements, and to lie fully against landing surfaces.
- I. Lubricate operating parts of lift, including drive mechanism, guide rails, hinges, safety devices, and hardware.

### 3.2 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of lift installation and before permitting use of lifts, perform acceptance tests as required and recommended by ASME A18.1 and authorities having jurisdiction.

- B. Operating Test: In addition to acceptance testing, load lifts to rated capacity and operate continuously for 30 minutes between lowest and highest landings served. Readjust stops, signal equipment, and other devices for accurate stopping and operation of system.

### 3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lifts. Include a review of emergency systems and emergency procedures to be followed at time of operational failure and other building emergencies.
- B. Check operation of lifts with Owner's personnel present and before date of Substantial Completion. Determine that operating systems and devices are functioning properly.
- C. Check operation of lifts with Owner's personnel present not more than one month before end of warranty period. Determine that operating systems and devices are functioning properly.

END OF SECTION 144200

## SECTION 149182 - TRASH CHUTES

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Waste chutes.

#### 1.2 DEFINITIONS

- A. Chase: The shaft that encloses a chute.
- B. Intake Door: Door or hatch that penetrates the chase wall and chute, and through which materials are fed into the chute.
- C. Discharge Door: Door or hatch at the bottom of a chute, through which materials exit the chute.
- D. Access Door: Door other than an intake or discharge door that penetrates the chase wall for service access to devices in the chase.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chutes.
- B. Shop Drawings:
1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include each type and location of intake, discharge, and access door.

- C. Coordination Drawings: Plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Size and construction of chase enclosing each chute; locations for power, signal, and control wiring; and sprinkler-piping and water-service connections.
  - 2. Chute-discharge locations coordinated with compactor-intake or container locations.
- D. Product Certificates: For each type of chute, from manufacturer.
- E. Operation and Maintenance Data: For chutes to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. U.S. Chutes Inc.; Division of U.S.C. Group
  - 2. Wilkinson Hi-Rise

### 2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing and inspecting agency, for fire-protection ratings indicated.
  - 1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
  - 2. Intake Doors: UL "B" Labeled, 1-1/2-hour fire-resistance rated with 30-minute temperature rise of 250 deg F.
  - 3. Access Doors: UL "B" Labeled, 1-1/2-hour fire-resistance rated with 30-minute temperature rise of 250 deg F.
- B. Discharge-Door Assemblies: Fire-resistive door construction according to NFPA 252 or UL 10B requirements for fire-rated door assemblies.
  - 1. Minimum 16 gauge aluminized steel type "A" open end chute discharge rolling steel door with 165°F. fusible link hold open on an inclined steel track at the bottom of the chute to close automatically when the ambient temperature reaches 165°F. as required by city or state building and/or fire codes.

- C. 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.
- D. Standard: Provide chutes complying with NFPA 82.

## 2.3 CHUTES

- A. Chute Metal: Aluminized steel.
  - 1. Thickness: Minimum 16 gauge.
- B. Chute Size: 24-inch diameter.
- C. External Reinforcing for Offsets: Additional thickness of 0.11-inch thick chute metal with bracing to structure.

## 2.4 DOORS

- A. Intake-Door Assemblies: ASTM A 240, Type 304, stainless-steel self-closing units with positive latch and latch handle, with stainless-steel trim; constructed as required for performance requirements indicated; and with frame suitable for the enclosing chase construction.
  - 1. Door Type: Bottom hinged, hand operated self-closing positive latching.
  - 2. Size: Manufacturer's standard size for door type, chute type, and diameter indicated.
  - 3. Finish: Manufacturer's standard satin or No. 3 directional polish.
  - 4. Latchset: Manufacturer's standard.
  - 5. Mechanical Interlocks: Interlock system for system servicing, operated from discharge door to automatically lock intake doors.
  - 6. Electrical Interlocks: Interlock system that is energized by opening one intake door; remaining intake doors automatically lock when system is energized.
  - 7. Baffles: Rubber backdraft baffles at each intake.
- B. Discharge-Door Assemblies: 16 gauge aluminized steel type "A" open end chute discharge rolling steel door with 165°F. fusible link hold open on an inclined steel track at the bottom of the chute to close automatically when the ambient temperature reaches 165°F. as required by city or state building and/or fire codes.
- C. Detector System: Heat- and smoke-detecting interlock system with temperature-rise elements that locks chute doors when temperature in chute reaches a predetermined, adjustable temperature.
  - 1. Locate smoke detector outside discharge door with solenoid to close discharge door.

- D. Access-Door Assemblies: Manufacturer's standard hand operated, self-closing, positive latching, UL 1 1/2-hour. "B" labeled complying with ASTM A 240, Type 302/304, stainless-steel doors with trim; constructed as required for performance requirements indicated; with frame suitable for the enclosing chase construction; and in satin or No. 3 directional polish finish; equipped with cylinder locks that release latch with keys that are removable only when cylinder is locked.
1. Lock Cylinder: Provide cylinders that match and are keyed to the building system.
  2. Keying: Key access-door cylinders to master key system.
  3. Keys: Three for each cylinder.
- E. Manual Control System: Control system with manual switch that lock chute doors during shutdown hours and service operations.

## 2.5 ACCESSORIES

- A. Chute Fire Sprinklers: NFPA 13; manufacturer's standard, recessed, automatic, NPS 1/2 sprinklers; ready for piping connections.
- B. Flushing Spray Unit: NPS 3/4 spray-head unit located in chute above highest intake door, ready for hot-water piping connection, and with access door for spray-head and piping maintenance. Provide additional 1/2-inch sprinkler heads at every second intake (counting from the top) or as required by local code.
- C. Disinfecting and Sanitizing Unit: NPS 3/4 disinfecting and sanitizing spray-head unit located in chute above highest intake door, including 1-gal. tank and adjustable proportioning valve with bypass for manual control of sanitizing and flushing operation, ready for hot-water piping connection, and with access door for spray-head and piping maintenance.
- D. Intake-Door Baffles: Rubber baffles, 1/8 inch thick.
- E. Sound Dampening: Manufacturer's standard sound-deadening coating on exterior of chute sound and vibration isolator pads at supporting frame at each floor penetration.

## 2.6 FABRICATION

- A. General: Factory-assemble chutes to greatest extent practicable with nonleaking, continuously welded or lock-seamed joints without bolts, rivets, or clips projecting into chute interior. Include intake-door assemblies, metal supporting framing at each floor, and chute expansion joints between each support point.



1. The trash chute shall be fully factory assembled and all joints, except those required to separate the sections for shipment and installation shall be welded or lock-seamed tight. The floor intake doors shall be bolted in place on throats formed into the chute. All chute sections shall flash inside the sections below and there shall be no bolts, clips, or other projections inside the chute to snag the flow of material. Pre-positioned support frames shall assure proper intake levels and there shall be an expansion joint in the chute between all support joints. Discharge hoppers and offsets, where required, shall be reinforced and separately supported in the impact area.
- B. Offsets: Construct offsets where indicated on Drawings. Fabricate so that installed chute is without obstructions that might prevent materials from free falling within chute. Offsets shall be made the same diameter and gauge as the chute and have an additional layer of 13 gauge aluminized steel reinforcing the impact area.
  1. Offsets: Do not exceed a 15 degree maximum offset angle at any point, or place offset closer than 48 inches to nearest door above offset.
  2. External Reinforcing: Externally reinforce impact area of offsets located below top intake door. Install vibration isolators where braced to structure.
- C. Roof Vent: Fabricate vent unit as full-size extension of chute, open to the atmosphere. Extend vent to height above roofing surface as indicated on Drawings. Equip vent with full insect screening and metal explosion-release cap. Fabricate with roof-deck flange, counterflashing, and clamping ring of nonferrous metal compatible with chute metal.
- D. Chute Fire Sprinklers: Install internally within chute, recessed out of the chute area through which material travels, and according to NFPA 13.
  1. Locate sprinklers at or above the top intake door of the chute, and in addition, a sprinkler shall be installed within the chute at alternate floor levels and with sprinkler located at the lowest service level.
- E. Equipment Access: Fabricate chutes with access for maintaining equipment located within the chute, such as flushing and sanitizing units, fire sprinklers, and plumbing and electrical connections.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install and test chutes before installing enclosing chase construction.
- B. Install chutes according to NFPA 82 and manufacturer's written instructions. Assemble components with tight, nonleaking joints. Anchor chutes securely to supporting structure to withstand impacts and stresses. Install chute and components to maintain fire-resistive performance of chute and the enclosing chase construction.
- C. Install chutes plumb, without obstructions that might prevent materials from free falling within chutes.

## SECTION 211000 - FIRE PROTECTION

All Conditions and Addenda thereto govern the work of this Section.

### PART 1 - GENERAL

- 1.1 The work performed under this Section shall be by a State of Florida certified Fire Protection Contractor I with a minimum of 5 years experience.
- 1.2 This section shall govern the furnishing of all labor, equipment, materials and services necessary to install complete operating wet sprinkler systems, fire pump, in strict accordance with NFPA 13, 20, and 24 and all applicable specifications.
- 1.3 All threads shall be in accordance with local fire department specifications.
- 1.4 Standards: All equipment and devices shall be U.L./F.M. approved.
- 1.5 SCOPE
  - A. Work includes, but is not necessarily limited to the following:
    1. Automatic sprinkler systems, (1) free standing fire department connection and fire hydrant with supply underground mains, fire pump, underground mains, any and all accessories as shown on drawings or as required by the local fire department and NFPA 13, 20, and 24, or Architect/Engineer.
    2. Contractor shall visit site to check all existing conditions prior to bidding.
    3. Not less than six (6) sets dated shop drawings and hydraulic calculations along with one (1) set OCI Associates, Inc. fire protection drawings and calculations shall be submitted to the local fire department planning office for stamped approval. The approved copies are then to be submitted to Architect and Engineer for approval prior to commencing any construction.
    4. Material submittals shall be submitted to Architect/Engineer on all fire protection items and/or equipment for approval and shall be approved before any installation.
    5. Tests shall be conducted pursuant to NFPA 13 and 24.
    6. Inspection and final approval shall be by local Fire Department and Architect/Engineer.
    7. Obtain all applicable permits and adhere to all governmental requirements.
    8. Backfill and compaction to normal grade will be by this Contractor. Contractor to verify water tables and be responsible for de-watering if required.

- 1.6 Auxiliaries and Accessories: Include all auxiliaries and accessories for complete and properly operating systems.
- 1.7 Coordination: Provide all required coordination and supervision where work connects to or is affected by work of other trades.
- 1.8 Layout of Work: Correlate final equipment location with governing Architectural and Structural drawings. Lay out work before installation so that all trades may install equipment in spaces available. Provide coordination as required for installation in a neat and workmanlike manner.
- 1.9 Provisions for Openings: Locate all openings required for work performed under this section. Provide approved fire rated black steel Schedule 40 sleeves to allow passage of items installed under this section.
- 1.10 Supervision of the Work: Provide a field superintendent who has had previous successful experience on projects of comparable size and complexity. Superintendent shall be present at all times that work is being installed. Submit the proposed superintendent's experience qualifications for Architect/Engineer's review.
- 1.11 Protection and Clean-Up: Suitably protect all equipment furnished under this Division during construction. All rubbish occasioned by this installation shall be periodically removed from the premises and all exposed work shall be thoroughly cleaned prior to final acceptance. Restore any damaged surfaces and items to "like new" condition before a request for final acceptance.
- 1.12 Reports on Progress of Work Memo: Items noted during construction and before final acceptance which do not comply with the Contract Documents will be listed in a "Report on Progress of Work Memo" which will be sent to the Contractor for action. The Contractor shall have these items corrected, and shall sign and enter the date on which the item was corrected on two copies of the memo as indication that the item was corrected, and return the signed memos so items can be rechecked. Failure to return the signed memos shall be cause for disallowing monthly request for payments. Items noted after acceptance during one year guarantee period shall be checked by the Contractor in the same manner as above and signed memos returned by him when the items have been corrected.
- 1.13 Progress and Record Drawings: Keep two sets of white prints on the job. Neatly mark up design drawings with colored pencils each day as components (incorporate any/all changes to original design) are installed. Different colored pencils shall be used for different systems. Cost of prints shall be included under this Division. At the end of the project, all changes shall be transferred to a set of sepias of the design drawings to be forwarded to Engineer. Cost of the sepias and of the drafting involved shall be included under this Division.
- 1.14 Until system is completed, tested and accepted, this Contractor shall be responsible for repair of leaks, and accidental breaks.

- 1.15 Contractor shall instruct Owner's designated employee in the proper operation and maintenance all fire protection systems and/or equipment. Contractor will also furnish Owner with two (2) sets of typed operating instructions in hard cover - 3-ring binders.
- 1.16 Performance Verification: Operate systems as required to demonstrate that the systems are operating correctly in accordance with the design, (this is to include line pressure testing). Supply instruments required to read data. Adjust systems to operate at the required performance levels. Advise Engineer 3 working days in advance of the time that the work will be done. Tabulate data for submission. Submit tabulated data on 8-1/2" x 11" sheets with data, time and name of checker with one copy for each technical information brochure. Data shall be submitted and approved before Check-out Memos are signed or a request for final inspection is made.
- 1.17 Guarantee: Contractor shall guarantee in writing, his responsibility for defective materials and workmanship for a period of one (1) year from date of Final Acceptance issued by the Architect and correct any deficiencies, labor and material, without additional cost to Owner.
- 1.18 Instruction to Owner: Submit all required items for checking one week before final inspection of the building is scheduled. When all items are approved and placed in the proper brochures, the Contractor shall give notice in writing that he is ready to give the Owner an "Instruction in Operation Conference". After the above mentioned request is received, the Contractor will be notified of the time the conference can be held with the Owner. At the conference, the Contractor shall review with the Owner all appropriate information. At the end of the conference, seven copies of an Instruction in Operation Conference Memo shall be signed by the Contractor, Subcontractor and Owner and one copy inserted in each brochure.
- 1.19 Time Schedule for Final Inspection of System: All work on the System shall be complete and all forms and other information shall have been submitted and approved before the request for a substantial completion inspection is made.
- 1.20 Roughing-in for equipment by others: Rough in all equipment requiring connections to systems furnished by this division and by others. Verify requirements and correct locations before proceeding with work.
- 1.21 Technical Information Brochure: Submit before start of construction or within ten days after award of the Contract.
  - A. Each brochure shall consist of an adequately sized, hard-cover, 3-ring binder for 8-1/2" x 11" sheets. Provide correct designation on outside cover and on end of brochure.

## PART 2 - MATERIALS AND METHODS

- 2.1 Pipe shall be new, designed for 175 PSI working pressure, conforming to ASTM specifications, and have the manufacturer's name or brand, along with the applicable ASTM standard, marked on each length of pipe.

- 2.2 2" or smaller pipe and all screwed pipe shall be steel, Schedule 40, black, and in accordance with specifications ASTM A120 or A53.
- 2.3 2-1/2" or larger pipe shall be steel, Schedule 10, black, and in accordance with specification ASTM A135.
- 2.4 Schedule 40 black steel pipe shall be joined by screwed joints in accordance with specification ANSI B2.1.
- 2.5 Schedule 10 black steel ASTM A135 sprinkler pipe shall be joined by UL and FM approved mechanical couplings. Couplings may be of the rolled groove type or the mechanical locking type (push-on). Grooves for the rolled groove type shall be rolled only (die cut grooving will not be permitted) and they shall be dimensionally compatible with the coupling.
- 2.6 All black steel pipe must be preoxidized with a suitable protective coating. All pipe and valving shall be installed rust-free.
- 2.7 All ASTM A53 and ASTM A120 sprinkler pipe must be hydrostatic tested at the mill pursuant to the ASTM standard.
- 2.8 All ASTM A135 sprinkler pipe must be tested with a non-destructive electric test for continuous and uninterrupted inspection of the welded seam.
- 2.9 Screwed fittings shall be cast iron, 125 lb. class, black, and in accordance with ANSI B16.4 or malleable iron, 150 lb. class, black, and in accordance with ANSI B16.3. Style of fittings shall be Stockham or ITT Grinnell.
- 2.10 Flanged fittings shall be threaded, cast iron, short body, Class 125, black, and in accordance with ANSI B16.1. Gaskets shall be full face of 1/8" minimum thickness red sheet rubber. Flange bolts shall be hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated, having dimensions in accordance with ANSI B18.2. Grooved flanges shall not be permitted. Style of fittings shall be Stockham or ITT Grinnell.
- 2.11 Welded branch connections shall be steel; standard weight, black, in accordance with AWS D10.9 and ANSI B31.1. Weld branch connections to main shall be permitted when pipe size of the branch line is more than (2) two nominal pipe sizes smaller than main. Style of welded connections shall be Allied.
- 2.12 Grooved couplings and mechanical fittings shall be malleable iron, 500 PSI working pressure, in accordance with ASTM A47. Coupling gasket material shall be butyl rubber. Grooved couplings and mechanical fittings shall be tested and listed by UL and/or FM. Style of grooved coupling/fittings shall be Victaulic. Grooved mechanical fittings such as; mechanical tees, roust-a-bout, plain end fitting, hookers, etc. shall not be used unless written permission from Engineer is obtained prior to any submissions or installation.
- 2.13 Underground piping shall be UL-FM approved, ductile iron, water pipe Class #52. Fittings shall be Class 250, Mechanical Joints. Install in strict accordance with NFPA 24. All

underground bends shall be rodded and thrust blocked. All pipe shall be installed rust-free.

- 2.14 Corrosion Protection: Supply pipes, risers, branch lines, fittings, hangers, sprinkler, or any/all fire protection materials that are installed where corrosive conditions exist, or moisture may be present. The contractor shall provide protective coating that resists corrosion ie. galvanization. Galvanized painting shall not be permitted.
- 2.15 Automatic sprinkler heads shall have temperature ratings of fusible elements to be in accordance with N.F.P.A. -13.
- 2.16 Furnish spare sprinkler heads of each type, with wrench, in wall mounted cabinet. As required by NFPA #13 3-16.7.3.
- 2.17 See drawings for sprinkler types and locations and/or Architect or Engineer.
- 2.18 Coordinate sprinkler spacing with all other trades as required.
- 2.19 Hangers: Methods of hanging pipes, headers and branches shall be approved by NFPA No. 13. All hangers on 4" pipe and larger is to be Clevis type hangers. Powder driven studs shall not be permitted. All hangers shall be U.L./F.M. approved.
- 2.20 Tests: Hydrostatic tests shall be conducted in accordance with the "National Fire Codes." Tests must be witnessed by Owner's representative.
- 2.21 Codes: Wherever, or whenever questions may arise, approval and directions shall be guided by the "National Fire Codes" and/or Architect-Engineer.
- 2.22 All wet-pipe system pipe sizes have been hydraulically proven and classified in strict accordance to N.F.P.A. #13.
- 2.23 Fire extinguishers shall be provided under other divisions of this specification.
- 2.24 Furnish and install (1) alarm check valve with variable pressure trim and water motor alarm - see drawings for detail size and locations. Style of valve, trim, water motor alarm, shall be Gem F200 valve/variable pressure trim/F630 water motor alarm or Viking G-1 valve/variable pressure trim/E-1 water motor alarm.

OR

- 2.25 Provide and install complete with all accessories including trim work indicated in the fire protection details, pre-action systems as shown on the drawings. The fire protection contractor shall submit to the Architect/Engineer a complete set of drawings indicating pipe layout, valve configuration and all details required for system installation. All preaction system components shall be manufactured by Viking Corporation. The fire protection contractor shall coordinate with the fire alarm contractor to provide proper interface with the fire alarm system. Upon activation of the fire alarm system by an automatic device (by the fire alarm contractor) located within a preaction system area, the preaction system shall fill with water.

- 2.26 Furnish and install (2) 2-1/2" X 2-1/2" X 4" recessed fire department connection with chrome finish - see drawings for location. Style of F.D.C. shall be Potter Roemer 5022DF or Elkhart #165.
- 2.27 Provide and install post indicator valves. See drawings for detail, size and locations. Style of post indicator valves shall be Mueller Adjustable #G-1 or Stockham #G-951.
- 2.28 Electric Waterflow Devices and Supervisory Switches:
- A. Furnish devices for installation of electrical flow and valve supervisory switches, whose function is to respond to flow in the sprinkler system and to sound an alarm if any system valve is closed.
  - B. Waterflow detector device shall have built-in pneumatic retard device with automatic reset dial and two snap-action SPDT switches (U.L./F.M. approved).
  - C. Style flow switches shall be Notifier.
  - D. All exterior switches shall be rated for outside installation.
- 2.29 Coordinate with Electrical Contractor to insure all fire protection electrical items have been properly completed.
- 2.30 Electrical switches shall be furnished and installed under this Division and wired under Division 26.
- 2.31 Gate valves for fire service shall be approved by the Underwriters' Laboratories, Inc., and the Factory Mutual Laboratories. Valves shall be factory marked "UL" and "FM", 175 PSI working pressure. Gate valves 2-1/2" or larger shall be flanged O.S. & Y. type. Butterfly valves shall not be used. Gate valves 2" or smaller shall be butterball type. Style of valves shall be Stockham #G-634 or Mueller #B-1.
- 2.32 Check valves for fire service shall be approved by the Underwriters' Laboratories, Inc., and the Factory Mutual Laboratories. Valves shall be factory marked "UL" and "FM", 175 PSI working pressure. Spring loaded wafer check valves shall be used aboveground. Style of valves shall be Mueller or Mission.
- 2.33 AUTOMATIC FIRE PUMPS
- A. General: Furnish and install a jockey pump with controller and diesel engine driven fire pump. Each individual pump shall be factory run tested prior to shipment.
  - B. Jockey Pump:
    - 1. The jockey pump shall be a vertical or horizontal centrifugal type with cast iron case, stainless steel shaft, bronze impellers and wear rings, packing or mechanical seal, threaded suction and discharge connections, and close-coupled open drip-proof motor.

2. Jockey Pump Controller: Shall be completely assembled, wired, and tested at the factory and bear UL/FM label. . The unit shall be complete with across-the-line magnetic starter equipped with 3-coil overload protection, 3-pole fusible disconnect switch, H-O-A selector switch, Bourdon tube type pressure regulator, minimum running period timer, pump running light, and in a NEMA enclosure. Controller shall be provided by pump manufacturer and equal to Firetrol Model FTA-750.
  3. Jockey pump shall be provided as specified on the fire protection drawings.
- C. Jockey Pump Controller:
1. Controller shall permit the jockey pump to maintain pressure on the sprinkler systems at all times.
  2. Pump start pressure shall be slightly above the fire pump start pressure; stop pressure shall be fire protection system pressure. Should system pressure drop such that the jockey pump cannot build up to system pressure, the fire pump shall automatically start.
- D. Fire Pump, Diesel Engine Driven:
1. The fire pump assembly consisting of pump, diesel engine w/heat exchanger and controller, shall be listed for fire pump service by Underwriter's Laboratories and Factory Mutual and shall be acceptable for horsepower ratings established by these laboratories. The fire pump assembly shall be capable of delivering to the fire system, its rated flow and pressure continuously for 8 hours duration. Assembly rating shall not be less than that shown on the drawings. System shall be capable of starting and coming up to rated speed, within a maximum time of 10 seconds. The pump shall also deliver not less than 150% of rated capacity at a pressure not less than 65% of rated pressure. The pump suction shall have a residual pressure at pump capacity of 10 PSI. Fire pump shall meet all requirements of NFPA #20.
  2. The pump shall be horizontal split case design, casings shall be cast iron having a minimum tensile strength of 30,000 PSI. The removal of the upper half of the casing must allow removal of the rotating element without disconnecting the suction/discharge piping.
  3. Impeller shall be of the enclosed type and shall be of cast bronze. Impellers shall be dynamically balanced, keyed to the shaft and held in place by threaded shaft sleeves.
  4. Provide packing type seals, stainless steel shaft sleeves and carbon steel impeller shaft.



5. The pump shall be directly driven through a flexible coupling, and a coupling guard shall be provided.
6. The following accessories shall be provided with each pump: suction eccentric reducer, pump casing relief valve, concentric tapered discharge increaser, discharge tee, pressure gauges, main relief valve, enclosed relief cone, circulation relief valve, automatic air release valve, splash shield, and test header.
7. The pump, driver, and pump control panel shall be mounted on a common factory supplied base of the cast iron or structural steel type incorporating a drip pan and positive provisions for driver and pump alignment and coupling guard mounting.
8. All steel parts shall be suitably cleaned and treated to inhibit rust and painted with the manufacturer's standard finish method.
9. Pump shall have right hand (clockwise) rotation.
10. Diesel fire pump shall be provided as specified on the fire protection drawings.

E. Engine:

1. Solid injection, full compression ignition type engine. Either vertical or V-type, four stroke cycle design. Nominal brake horsepower rating. Piston speed not to exceed 2000 feet per minute. Fuel consumption not greater than 1 pint per hour per b.h.p. at rated load.
2. Fuel injection pumps and injection valves shall be of a type not requiring adjustment in service. Fuel injection pumps; positive action, constant stroke pumps, actuated by cam driven gears from the engine camshaft. Fuel lines between injection pumps and valves shall be heavy seamless tubing and of the same length for all cylinders. Fuel systems shall be equipped with fuel filter having replaceable elements which may be easily removed from their housing for replacement without breaking any fuel line connections or disturbing the fuel pumps or any other part of the engine. All fuel filters shall be conveniently located in one accessible housing, ahead of the injection pumps so that fuel will be thoroughly filtered before it reaches the pumps.
3. No screens or filters requiring cleaning or replacement shall be used in the injection pump or injection valve assemblies. Engine shall be equipped with a built-in gear type, self-priming, engine driven fuel transfer pump capable of lifting fuel against a suction head of 12 feet and supplying fuel from the main fuel storage tank through the filters to the injection pump at constant pressure.
4. Engine driven gear type lubricating oil pumps for supplying oil under pressure to main bearings, crank pin bearings, pistons, piston pins, timing gears, camshaft bearings, valve rocker mechanism and governor. Provide effective lubricating oil filters, so located and connected that all oil being circulated is

continuously filtered and cleaned. Filters shall be accessible, easily removed and cleaned, and equipped with a spring loaded bypass valve as insurance against stopping lubricating oil circulation in event the filters become clogged. Engine shall have a suitable water cooled lubricating oil cooler.

5. Provide one or more dry type air cleaners of sufficient capacity to effectively protect the working parts of the engine from dust and grit.
6. The engine shall be capable of satisfactory performance on a commercial grade of distilled petroleum fuel oil such as No. 2 domestic burner oil. Diesel engines requiring a premium fuel will not be considered. Fuel system shall be provided to comply with manufacturer's recommendations, NFPA 31 and shall include tank, stand, filters, piping and flexible connections as required.
7. Day Tank - a 275 gallon day tank unit shall be provided under this Division. Tank shall incorporate threaded pipe connections, 120 volt AC suction pump, low and high level alarms, float switch, fuel gauge, check valve, and mounting brackets. Flexible fuel connections at engine shall be provided in accordance with NFPA #20. Day tank shall be Simplex, SFT-275A.
8. Equip engine with an automatic electric starting system, 24 volts D.C. minimum. Provide controls to automatically start the engine and automatically shut down the engine. Automatic starting controls shall be arranged to provide starting alternately between two batteries on successive starting attempts until start is accomplished or on six crank periods of 14 seconds each separated by five 15 second rest periods. Starter to be positive shift, gear engaging type designed to automatically disengage when engine starts. Provide necessary jacket water heaters to maintain engine at 100°F for rapid starting.
9. Provide cooling system of sufficient capacity for properly cooling engine when delivering full rated horsepower. Provide engine mounted heat exchanger for use in an ambient temperature not to exceed 125°F. The engine shall have an engine driven, centrifugal type water circulating pump for circulating water through the engine cooling system. Provide engine manufacturer's recommended anti-freeze for operation down to minus 10°F. Heat exchanger cooling water shall be supplied from the fire pump discharge.
10. Provide tachometer, dial type oil pressure gage, water temperature gauge, "Run-Stop-Auto" switch, "Start-Stop" terminals,
11. Provide factory mounted and prepiped heat exchanger cool water lines, pressure regulator, strainer, bypass piping and fittings for the engine cooling system.
12. Provide engine jacket water heater.
13. Provide flexible exhaust connector and critical rated exhaust silencer.

F. Fire Pump Controller (Diesel Engine Driven Pump):

1. Controllers shall be specifically listed for diesel engine driven fire pump service. Controller shall be marked "Fire Pump Controller" and shall show plainly the name of the manufacturer, identification designation, and wiring diagram and electrical rating.
2. Automatic engine controller shall be constructed to UL, FM, NFPA 20 and NFPA 70 standards.
3. Unit shall contain circuit breaks for power; control and battery charger circuits; battery charging rate ammeter(s); shut-down mode selector switch (auto/test-manual-auto) and main selector switch (manual-off-auto); engine safety shutdown due to low oil pressure; high coolant water temperature; engine crank pump button to permit all batteries to crank under hard start conditions; dual solid state battery chargers with charger failure, battery failure, and missing battery alarm features; externally mounted touch pad for information access to status report; alpha-numeric display to provide a complete status report on all controllers, engine and remote input and output contacts, switches and alarm functions; alarm functions shall include engine high water jacket temperature, failure to start, main switch mis-set, engine running, low fuel, and low suction pressure. Unit shall be equal to Firetrol Model FTA-1100.
4. Remote alarm capabilities shall be provided to indicate the following conditions:
  - a. Low oil pressure in the lubrication system.
  - b. High engine jacket coolant temperature.
  - c. Failure of engine to start automatically.
  - d. Shut down from overspeed.
  - e. Battery failure.
  - f. Controller main switch turned to off or manual position.
  - g. Low suction pressure.
5. Furnish one (1) UL/FM remote alarm panel in accordance with NFPA #20. To be installed, wired, and connected by Division 26 contractor. (See Electrical Drawing for location). Style shall be 1802B.
6. Automatic operation of controller shall be by a pressure actuated switch provided in the circuit to detect reductions of pressure in the fire protection systems and sequentially start the main fire pump.
7. Battery: Provide 24 volt nickel-cadmium type batteries with steel rack suitably treated to inhibit rust and finished with acid resistant paint. Battery shall be capable of cranking engine at the cranking speed recommended by the engine manufacturer through a 6 minute cycle (15 seconds cranking and 15 seconds rest, in 12 consecutive cycles). Provide voltage relay to signal low battery voltage condition at approximately 90% of cell voltage.

8. Dual battery chargers shall be solid state type with automatic charge designed to meet the requirements of NFPA 20 and to maintain batteries at nominal full voltage. Provide a D.C. voltmeter and D.C. ammeter for each battery circuit. Designed so that high rate charge is automatically applied when batteries are discharged to excessive levels. As battery voltage increases, automatically reduce rate until float level is reached and battery voltage is maintained. Include integral fuse protection. Arrange chargers so that A.C. power is always present, either from normal source or from standby source.

G. Service Facilities:

1. Pump manufacturer shall produce satisfactory evidence that a local factory authorized distributor maintains a fully equipped service organization located within a 150 mile radius of the project site, and is capable of furnishing to this system adequate inspection and maintenance service, including standard replacement parts.

H. Electrical:

1. All power wiring shall be accomplished By the Division 26 contractor. All control and interlock wiring shall be accomplished under this Section of the specifications in accordance with the requirements in Division 26.
- 2.35 Furnish and install 2-1/2" fire department hose valves with U.L./F.M. 2-1/2" X 1-1/2" reducer, cap and chain. See drawings for locations. Style of valves shall be Potter Roemer #4042 or Elkhart #U-25.
- 2.36 Furnish and install 8" backflow preventer - see drawings for location. Style of backflow preventer shall be FEBCO #806. Backflow preventer shall include backflow preventer and (1) O.S. & Y's factory assembled and shipped as one unit.
- 2.39 Furnish and install 2-1/2" hose valves for fire pump test header. Style of valves shall be Potter Roemer #4365 or Elkhart #U-25.
- 2.40 Furnish and install 10" electric bell(s) 24 DC. Style of electric bells shall be Notifier N-CO-Bell. See drawings for locations.
- 2.41 FUEL SYSTEM
- A. Day Tank: A 275 gallon day tank unit shall be provided under this Division. Tank shall incorporate threaded pipe connections, 120 volt AC suction pump, float switch, fuel gauge, check valve, and mounting brackets. Flexible fuel connections at engine shall be provided in accordance with NFPA #20. Day tank shall be Simplex, SFT 275A.

### PART 3 - INSTALLATION

- 3.1 General: All materials, equipment and accessories shall be installed in accordance with NFPA Standard No. 13, 20 and 24.
- 3.2 All pipe hangers shall be securely anchored to the building structural components and shall be listed and approved by UL-FM, and Architect/Engineer. (Powder driven anchors are not permissible.)
- 3.3 The entire system shall be flushed with clean water to remove debris resulting from installation.
- 3.4 Pumps shall be installed level and plumb on 4" minimum concrete housekeeping pads. Provide a 1/2" chamfer on the pad edges.
- 3.5 All required grouting shall be with non-shrink grout.
- 3.6 Service: The pump manufacturer shall assume unit responsibility, and shall provide a factory trained engineer to supervise initial start-up, to insure proper operation of the system, and to instruct the operating personnel in the operation and maintenance of the system.

### PART 4 - TESTING

#### 4.1 ACCEPTANCE TESTS

- A. Underground mains and lead-in connections to system risers shall be flushed before connection is made to sprinkler piping in order to remove foreign materials which may have entered the underground piping during the course of the installation. For all systems, the flushing operation shall be continued until water is clear.
- B. Underground mains and lead-in connections shall be flushed at a flow rate not less than indicated in the following table or at the hydraulically calculated water demand rate of the system, whichever is greater.

C. Main Flushing Rate Table:

Main Pipe Size	Flow Rate
4 in.	390 gpm
6 in.	880 gpm
8 in.	1560 gpm
10 in.	2440 gpm
12 in.	3520 gpm

- D. Provision shall be made for the disposal of water issuing from test outlets to avoid property damage.

#### 4.2 HYDROSTATIC TESTS

- A. Systems including yard piping shall be hydrostatically tested at not less than 200 psi pressure for 2 hours, or at 50 psi in excess of the maximum pressure, when the maximum pressure to be maintained in the system is in excess of 150 psi.
- B. The test pressure shall be read from a gage located at the low elevation point of the individual system or portion of the system being tested.
- C. The inside sprinkler piping shall be installed in such a manner that there will be no visible leakage when the system is subjected to the hydrostatic pressure test.
- D. Piping between the check valve in the fire department inlet pipe and the outside connection shall be tested the same as the balance of the system.
- E. Whenever a test blank is used it shall be of the self-indicating type. Test blanks shall have red painted lugs protruding beyond the flange in such a way as to clearly indicate their presence. The Contractor shall have all test blanks numbered so as to keep track of their use and assure their removal after the work is completed.
- F. Approval of Sprinkler Systems:
  - 1. The Contractor shall perform all required acceptance tests in accordance with NFPA 13, 20 and 24. Complete the Contractor's Material and Test Certificate(s), and forward the fire department approved certificate(s) to the Architect/Engineer for approval of the installation.
  - 2. All test certificate(s) shall be dated, signed and witnessed by the local fire department and/or other authority having jurisdiction. Submit one copy of each test certificate to Architect/Engineer.

#### PART 5 - HYDRAULIC CALCULATIONS

- 5.1 Contractor shall perform a flow test and hydraulic calculations at the time of construction to verify fire pump size and adequacy based on the latest flow data.
- 5.2 Submit calculations along with applicable drawings for review by local fire department.

END OF SECTION

## SECTION 220523 - VALVES, COCKS AND SPECIALTIES FOR PLUMBING SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install valves, cocks and specialties as indicated on drawings or specified herein.
- B. Valves, cocks and specialties may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary to the proper operation of the system shall be furnished and installed by subcontractor in an approved manner and location. Pressure ratings given for valves are steam working pressure. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equal material and pressure class will be accepted.
- C. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 WATER MAIN VALVES

- A. Water main valves are to be AWWA approved, gate valve, double disc, iron body, bronze trim, non-rising stem, flanged end, with 2" square wrench nut. Valve boxes are to be cast iron adjustable type for top flush with ground surface. Furnish a box for each underground valve shown on drawings.

Valves	Valve Boxes
Mueller No. A2380-6	Alabama Pipe Co. E2602
Stockham Fig. G-745	James B. Clow F2450
Crane No. 462	Mueller H10360

## 2.2 BALL VALVES

- A. 2-1/2- inches and smaller: Threaded or soldered ends, port area equal to or greater than connecting pipe diameter, class 125, two piece bronze body, bronze ball, bronze stem, teflon seat and seals. Acceptable manufacturers: Crane, Hammond, Jamesbury, Nibco, Stockham, and Walworth.

## 2.3 LAWN FAUCETS

- A. Lawn Faucets to be rough nickel plate, lock shield compression stop with removable handle, solid flange, female connection, with 3/4 inch male threaded hose end with anti-syphon device.

	1/2" Inlet	3/4" Inlet
Mueller Co.	H-8297	H-8297
Hammond	1000	1000
Chicago Faucet	293	387

,OR.

- B. Provide integral or separate stop for lawn faucet.

,OR.

- C. Lawn Faucets shall be as scheduled on the drawings.

## 2.4 GATE VALVES (THREADED)

- A. 3" and smaller threaded valves and 4" and smaller solder pattern valves, rising stem, iron wheel, rough brass body, solid wedge disc, screwed or union bonnet and finished gland nut - 150 psi class.

Threaded Pattern	Soldered Pattern
Crane 431	- - -
Powell 514S	1842S
Walworth 56	- - -
Lunkenheimer 2151	3150
Stockham B-122	B-124

## 2.5 GATE VALVES (FLANGED)



- A. 3-1/2" and larger; except for solder valves as noted above shall be flanged type with cast iron body, brass trim, brass seats, rising stem and iron wheel - 125 psi class.

Flanged Pattern  
Crane 465-1/2  
Powell 1793  
Walworth 726F  
Lunkenheimer 1430  
Stockham G-623  
or approved equivalent

## 2.6 CHECK VALVES (SWING)

- A. Check valves 3" and smaller shall have a pressure rating of not less than 200 psi threaded pattern and 125 psi solder pattern, wye pattern swing check with rough brass body, finished gland nut and regrinding bronze disc.
- B. Check valves larger than 3" shall be flanged pattern, 125 psi iron body swing check with renewable brass seat, disc and trim. Check valves on primary heating hot water or chilled water piping system shall be 200 psi WP brass or ferrosteeel body swing check valves, with renewable brass seat, disc and trim.

	Flanged Pattern	
	125 psi	200 psi
Crane	373	39E
Powell	559	576
Walworth	M-928F	M-970F
Lunkenheimer	1790	323
Stockham	G-931	---

## 2.7 CHECK VALVES (WAFER)

- A. Check valves 3" and larger flanged pattern shall have a pressure rating of 125 psi, globe type body, semm. steel body, stainless steel spring, bronze disc and bronze seat ring.

Williams-Hager	Figure 636
APCO	Series 600
Mueller	Nos. 105, 107, 109 and 113
Metraflex	Series 900

- B. Check valves on primary hot water piping systems shall be 200 psi, globe type body, semi steel body, stainless steel spring, bronze disc and bronze seat.

## 2.8 COCKS

- A. Provide tight shut off balancing cocks at locations indicated on drawings.
- B. Cocks 2" and smaller, square head bronze cocks 125 psi class with check.

Crane 254  
Powell 955  
Walworth 554  
Lunkenheimer 454,  
or approved equal

C. Cocks over 2", lubricated plug valves with semi-steel body 175 psi class.

Screwed 2" and 3"	Flanged 4" and over
Powell F 2200	Powell F 2201
Walworth 1700	Walworth 1700F
ACF R 1430	ACF R 1431
or approved equivalent	

D. Lubricated plug cocks over 6" shall have a geared or worm drive operator.

E. Lubricated plug cocks may be used in lieu of globe or gate valves on heating hot water or chilled water steel piping systems to facilitate installation of insulation. All 6" or smaller chilled water piping valves located above finished ceilings (unless located over drip pan), or below ceiling in a finished area of the building shall be lubricated plug cocks. Provide handle or operator for each valve.

## 2.9 BUTTERFLY VALVES

A. Butterfly valves may be used in lieu of gate valves or throttling valves when indicated on the drawings.

1. Design working pressure and temperature 150 psig and 180°F.

2. Materials of construction:

- Body: Malleable or ductile iron
- Disc: Aluminum bronze
- Stem: 416 stainless steel
- Bushings: Bronze
- Seat: Compound 230 Buna N or as per manufacturer's recommendation for specific service.
- Handle: Lever lock through 10" size, if valve is to be used for throttling service, provide infinite adjustment throttle plate.

B. Valves used for the isolation of equipment or for future connections shall have flanged ends or flange unions to permit removal of equipment and/or piping with the valve remaining in service.

C. Acceptable manufacturers are Keystone, Center Line or Demco.

## 2.10 BACK FLOW PREVENTER (REDUCED PRESSURE)

A. 3/4" to 4" size; ASSE Std. 1013, AWWA Std. C-506; unit shall have all bronze construction, stainless steel internal parts, test cocks and suitable for 175 psi supply

water pressure. Unit shall be furnished with factory mounted bronze inlet strainer, union and non-rising stem gate valves (on inlet and outlet). Watts Series 900 Beeco or approved equal.

- B. 4" to 6" size; ASSE Std. 1013, AWWA Std. C-506; unit shall have iron body construction, epoxy coated internal water way, stainless steel internal parts, test cocks and stainless steel bolts. Unit shall be furnished with inlet strainer and non-rising stem gate valves (on inlet and outlet). Watts Series 900 Beeco or approved equal.

#### 2.11 BACK FLOW PREVENTER (DOUBLE CHECK VALVE)

- A. 3/4" to 2"; ASSE Std 1015, AWWA Std. C-506; unit shall have bronze body, stainless steel internal parts, test cocks and rubber seating check valves. Unit shall be furnished with factory mounted bronze inlet strainer, union, and non-rising stem gate valves (on inlet or outlet). Watts Series 700 Beeco, or approved equal.
- B. 2-1/2" and 3"; ASSE Std. 1015, AWWA Std. C-506; unit shall have iron body, stainless steel internal parts, test cocks, and rubber seating check valves. Unit shall be furnished with flanged ends, factory mounted inlet strainer, union, stainless steel bolts and non-rising stem gate valves (on inlet and outlet). Watts Series 700 Beeco or approved equal.

#### 2.12 DIELECTRIC UNIONS

- A. Epco Sales, Inc., 3204 Sackett Avenue, Cleveland, Ohio; Capitol Manufacturing & Supply Company, Columbus; Patrol Valve Company, Cleveland, Ohio, or approved equal.

#### 2.13 FLEXIBLE METAL HOSE

- A. American Brass Co., Mason Industries, Chicago Metal Hose Co., or approved equal, 300 psig WP design flexible metal hose constructed of brass with brass wire braid covering.

#### 2.14 FLEXIBLE PLASTIC PIPE JOINTS

- A. Resist-O-Flex Co., Mercer Rubber Co., La Favorite Co., or approved equal, multiple bellows, guides, and restraining bolts or blocking. Joints shall be rated at 150 psig and 220°F continuous service.

#### 2.15 STEEL PIPING SYSTEM STRAINERS

- A. Malleable or cast iron, 125 psig working pressure. Free area of strainer - not less than 300 per cent cross sectional area of pipe. Strainer mesh, perforation size, and pattern as follows:

Pipe Size	Pattern	Mesh or Perforation Diameter
to 2 in.	threaded wye	20 mesh
2 to 4 in.	threaded wye	0.045 inch dia.
5 to 10 in.	flanged wye	0.125 inch dia.
12 in. up	flanged basket	0.125 inch dia.

## 2.16 COPPER PIPING SYSTEM STRAINERS

- A. Copper piping system strainers solder pattern with removable bolted flange on strainer leg. Strainer 40 mesh bronze screen, with free area of screen at least 3 times cross sectional area of pipe.

## 2.17 ACCESS PANELS

- A. Access panels (Milcor) Inland-Ryerson Construction Products Co., (Boico) Birmingham Ornamental Iron Co., or approved equal. Steel panels and frames shall be furnished with prime coat of rust inhibitor enamel. See plans for sizes (12 x 12 min.). Access panel styles as follows:

	Milco	Boico
Fire rated	1-1/2 hr. B. Label	1-1/2 hr. B. Label

## 2.18 SAFETY VALVES

- A. Safety Valves to be Manning, Maxwell & Moore, Watts Regulator, or Bell & Gossett Co., ASME rated as shown on the drawings and/or required by applicable codes.
- B. Refrigerant Safety Valves in accordance with USASI Code for refrigeration apparatus, and pipe discharge outside building.
- C. Protect water heaters with Watts, Beaton Cadwell or McDonnell Miller, combination automatic temperature and pressure relief valves (with manual lift lever). Relief capacity shall exceed input energy at 125 psig pressure and 210°F temperature.

## 2.19 AUTOMATIC AIR VENTS (AAV)

- A. Automatic Air Vents to be equal to:

(150 psig W.P)	(75 psig W.P)
Metraflex MV-15	Maid-O-Mist 7
Crane Co. 976	Bell & Gossett 7
Sarco 13W	Hoffman 79
Armstrong 1AV	

## 2.20 MANUAL AIR VENTS (MAV)

- A. Manual air vents shall be brass manual cock equal to Crane 700 series.

## 2.21 WATER HAMMER ARRESTERS

- A. Water hammer arresters (shock stops) shall be equal to those manufactured by Josam Manufacturing Company, Zurn Industries, Inc., Wade, Inc., MIFAB or Jay R. Smith Manufacturing Company.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install valves and cocks in horizontal piping with the valve stem in the vertical upright position.
- B. Install valves and cocks to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.
- \* C. Provide blow down valve on 1-1/2" and larger strainers (except refrigerant piping). Use valve not less than 1/2 strainer blow down outlet size.

### 3.2 ACCESS PANELS

- A. Furnish adequate number of properly sized access panels (12" x 12" minimum size) to adequately service and maintain systems installed under each section of specifications.
- B. Access panels shall be installed and painted under other divisions of these specifications. Exact panel location shall be designated by the subcontractor performing the work of this Section.
- C. Access panels are not required in exposed grid or other types of readily removable ceilings.
- D. Access panels shall not compromise the fire rating of the wall.

### 3.3 SAFETY VALVES

- A. Safety valves to have valve spindle enclosure with gland seal to minimize leakage and manual lift lever to check discharge required. Cut discharge pipe from safety valve on a 45 degree angle, pipe to floor and direct toward or into floor drain (unless noted otherwise on the drawings).

### 3.4 AUTOMATIC AIR VENTS

- A. Install automatic air vents with inlet isolation cock at locations indicated on drawings and at high points of hot and chilled water piping systems. Pipe vent discharge to drain pan, plumbing trap or to outside of building.

3.5 WATER HAMMER ARRESTERS

- A. Install water hammer arresters (shock stops) at the locations indicated on the plans and in accordance with size and placement recommendations given in Plumbing and Drainage Institute Standard PDI-WH201.

3.6 BACKFLOW PREVENTERS

- A. Water service back flow preventers shall be installed above grade and in such a manner to prevent the discharge relief opening from becoming submerged by ground water. Provide suitable protection to prevent assembly from freezing.

END OF SECTION

## SECTION 220700 - INSULATION FOR PLUMBING SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification Sections, apply to work of this section.

#### 1.2 SCOPE

- A. Above grade domestic hot water supply and recirculating piping.
- B. Below grade domestic hot water supply and recirculating piping.
- C. Above grade waste lines and trap from ice machines and waste lines receiving condensate from air conditioning units to a point of connection to a soil line receiving waste from 4 or more plumbing fixtures.
- D. Interior storm water piping.
- E. Above grade domestic cold water piping in vented attic, vented ceiling spaces and vented soffits with 3/4" fiberglass and all service jacket.
- F. Above grade exterior domestic cold water piping.
- G. Handicap lavatory exposed hot water and waste piping.
- H. Above grade fire protection piping in vented attic, vented ceiling spaces and vented soffits with 3/4" fiberglass and all service jacket.
- I. Above grade domestic chilled water piping.
- J. Below grade domestic chilled water piping.
- K. Domestic water chilled evaporator, chilled water compression or expansion tank; and other cold surfaces with operating temperatures of less than 70 degrees F.
- L. Domestic chilled water pumps.
- M. Above grade water piping exposed in unheated areas.
- N. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Materials listed in subsequent paragraphs of this specification are those used as basis of design; alternate manufacturer's equivalent projects as listed herein will be accepted. The insulation contractor shall verify materials and comply with requirements of NFPA 90, with regard to a flame spread rating of 25 or less and; a smoke developed/fuel contributed value of less than 50.

#### 2.2 MATERIALS

- A. Insulation and accessory materials to be as manufactured by the listed manufacturers or approved equal:

1. Calcium Silicate: Owens Corning "Kaylo", Manville "Thermo-12".
2. Fiberglass: Owens Corning, Knauf, CertainTeed, or Manville.
3. Foamed Plastic Insulation: Armstrong "Armaflex", U.S. Rubber "Ensolex", Gustin Bacon "Ultra-Foam", Owens Corning "O-C" Halstead Industrial Products, or approved equal.
4. Cellular Glass: Fed. Spec. HH-I-551a.
5. Extruded Polyethylene Insulation: Nomaco Inc. "Thermacell, Sentinel Energy Savings Products Division of Packaging Energy Groups, Inc., "Senflex" or approved equal.
6. Insulating Finish Cement: JM No. 301, BH Improved Super Powerhouse Cement, The Ruberoid Co., No. 412, or approved equal.
7. Mastics, Sealers and Adhesives:

	<u>Benjamin Foster</u>	<u>Insulcoustic</u>	<u>Childers</u>	<u>J-M</u>
Cellular glass 30-45 bedding mastic		40-10	CP-70	
General purpose 35-00 Series Vi AC Mastic			CP-10	375



mastic

Vapor barrier sealant (indoor)	30-35	IC-501	CP-30
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Adhesive	85-20		CP-89
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Fire retardant sealer (outdoor)	60-35	IC-531	
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Foamed Plastic & Adhesive			57
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Extruded Poly-ethylene	Therma-Cel 950 Adhesive
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8. Pipe Jacketing and Valve Covers (Ultra Violet Resistant): Zeston PVC, CEEL-Tite, Proto Corp. (Lo Smoke), or approved equal.
9. Metal Jacketing and Fitting Cover: Aluminum 0.016 gage (minimum) smooth or corrugated, Childers Products Co., General Aluminum Supply Co. (Gasco), Alcorjac by Insulcoustic Co., or approved equal.
10. Molded Fiberglass Fitting Insulation: Molded Acoustical Products, Inc., West Easton, PA, 18042 or approved equal.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Insulation is not to be installed until the piping systems have been checked and found free of all leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.
- B. Provide hanger or pipe support shields of 16 gage (minimum) galvanized steel over or embedded in the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Securely fasten shield with pipe straps at each end. Insulate pipe anchors adequately to prevent moisture condensation problems.
- C. Insulation installed in exposed locations such as water heater rooms, equipment rooms, air handling unit rooms, all exterior above grade areas, kitchens, laundries, power houses, utility buildings, energy building or similarly identified locations where the insulation would be subject to physical damage shall be covered with metal jacketing. Elbows may be covered with fire rated and ozone resistant (for exterior locations) PVC covers in lieu of metal jacket.

### 3.2 WARM OR HOT SURFACES

- A. Insulate interior warm or hot surfaces with an operating temperature of over 120 degrees F and less than 400 degrees.
- B. These surfaces include hot water storage heater.
- C. Insulate with 1-1/2" thick calcium silicate blocks, securely wired on and covered with poultry wire. Apply a finish coat of 1/2" insulating finish cement over the poultry wire. Trowel the exterior smooth.
- D. Insulate hot surfaces operating at over 100 degrees F temperature with 3/4" V-rib spacing lath and 1-1/2" molded 85% magnesia or calcium silicate blocks wired on over the spacing lath. Apply poultry wire over the magnesia blocks and give a 1/2" coat of insulating finish cement. Trowel the exterior smooth.

### 3.3 EMERGENCY GENERATOR MUFFLER AND EXHAUST PIPING

- A. Shall be insulated with two 1-1/2" layers of calcium silicate block insulation. All joints shall be staggered and the blocks shall be installed with corrosive resistance stainless steel tie wires. The insulation shall be finished with a skim coat of Johns-Manville hydraulic setting insulation cement and covered with a layer of Underwriters grade cloth. The cloth shall be sized with Foster's 30-36 fire retardant coating or equal.

### 3.4 COLD SURFACES

- A. Cold surfaces with operating temperatures below 70 degrees F to be insulated with 1" thickness foamed plastic or extruded polyethylene insulation. Surfaces include, but not limited to, domestic water chiller, domestic chilled water air separator, domestic chilled water expansion tank, domestic chilled water pump, and refrigerant suction line intercooler. The foamed plastic sheets shall be applied over a heavy coating of Johns-Manville #57 adhesive. The insulation shall be finished with a heavy coat of white aerotube finish.

### 3.5 CONDENSATE PIPING FROM ICE MACHINES

- A. Insulate condensate piping and waste lines from ice machines with foamed plastic insulation or extruded polyethylene, one-half inch thickness.
- B. Mitre cut insulation to fit the pipe fittings. Use approved cement to seal all joints, seams, and ends in the insulation.

### 3.6 HORIZONTAL RAIN WATER PIPING

- A. Shall be insulated with 1/2" thickness fiberglass pipe insulation. Prior to installing with insulation the pressure release paper shall be removed from the jacket laps. Pipe insulation shall be secured in place by applying pressure to the pressure sensitive closure system. Elbows shall be insulated with fiberglass inserted into

25/50 rated PVC (Aluminum) fitting covers.

- B. Insulation shall begin at the base of roof drain body and include piping elbows at change of directions from vertical to horizontal.

### 3.7 HORIZONTAL WASTE PIPING RECEIVING AIR-CONDITIONING CONDENSATE

- A. Shall be insulated with 1" thickness AP-T fiberglass pipe insulation. Prior to installing with insulation, the pressure release paper shall be removed from the jacket laps. The insulation shall be secured in place by applying pressure to the pressure sensitive closure system. All fittings shall be insulated with pipe insulation segments and finished with Foster's 30-35 vapor barrier coating or equal, reinforced with white open weave glass fabric.

### 3.8 DOMESTIC CHILLED WATER PIPING

- A. Insulate domestic chilled water piping as described in these paragraphs with cellular glass. (Cellular glass with a factory applied glassfab jacket is acceptable.) Mitre cut insulation and carefully fit to the pipe fittings. Piping 6 inch and smaller, use 1-1/2" thickness insulation; piping over 6 inch diameter, use 2" thickness insulation. All cellular glass shall be shop bore-coated with Keen's cement prior to shipment to the job site. All pipe insulation joints shall be buttered with Foster's GPM 3500 or equal. The insulation sections shall be wired in place with 16 gauge copper or stainless steel wires spaced approximately 9" on center. Valves and fittings shall be insulated with prefabricated or pre-formed sections of cellular glass insulation and finished the same as adjacent piping.
- B. Finish cellular glass insulation in concealed locations by applying a heavy coat of Foster's GPM 3500 vapor barrier sealant to the exterior surface of the cellular glass. Embed a layer of open weave glass fabric cloth in this sealant overlapping seams at least 2". Apply a finish coat of Foster's GPM 3500 and finish as smooth as possible. Note: Two coats of sealer will be required where factory applied glassfab jacket is used.
- C. Finish cellular glass in exposed interior locations such as air handling unit equipment rooms, boiler rooms, and chiller room as follows:
  - 1. Straight runs of 2" piping and larger - cover with 0.016" thickness smooth aluminum weatherproof jacket with factory applied integral vapor barrier. Piping 2" and smaller - 0.010" thickness aluminum jacket with integral vapor barrier. Seal joints to preserve integrity of vapor barrier. Fasten jacket with 1/2" wide aluminum bands on not over 12" centers. Elbows, tees, reducers, valves and other special fittings - use prefab jacket.

### 3.9 UNDERGROUND PIPING

- A. Insulate all underground domestic hot and chilled water piping with 1-1/2" thickness cellular glass preformed split sectioned pipe insulation.

- B. Mitre cut insulation and carefully fit to the pipe fittings. All cellular glass to be shop bore-coated with Keen's cement prior to shipment to the job site. Apply cellular glass bedding mastic to all edges of the cellular glass insulation to fill any voids between joints in the insulation.
- C. Wire the Cellular glass in place with stainless steel or copper wire 9" on centers. Expansion joints in the insulation with 1/4" clearance shall be made 10' on centers. The expansion joints shall be filled with asphalt impregnated felt and covered with the jacket.
- D. Apply a heavy coat of vapor barrier sealant to outside of the cellular glass and embed a layer of open mesh glass fabric cloth into the mastic; carefully apply the cloth smoothly and overlap all transverse and longitudinal joints at least 2". Apply a second heavy and final coat of mastic over the cloth and finish to a reasonably smooth surface.
- E. All legs of underground expansion loops and expansion ells shall be additionally covered with 2" thickness fiberglass 7-1/4 pounds per cubic foot density fiberglass pipe insulation applied under the cellular glass and under the glass fabric.

3.10 ABOVE GROUND DOMESTIC COLD WATER, DOMESTIC HOT WATER AND DOMESTIC HOT WATER RECIRCULATION PIPING

- A. Shall be insulated with ASJ fiberglass pipe insulation. Prior to installing the insulation, the pressure release paper shall be removed from the jacket laps. The insulation shall be secured in place by applying pressure to the pressure sensitive closure system. All fittings shall be insulated with molded fiberglass pipe insulation segments and finished with Foster's 30-35 vapor barrier coating or equal, reinforced with a layer of white open weave glass fabric.
- B. Main pipe sizes 2-1/2" and smaller shall have 1" thickness insulation unless noted on the drawings.
- C. Pipe sizes 2-1/2" and larger shall have 1-1/2" thickness insulation.
- D. Branch runouts up to 2" shall have 1/2" thickness insulation.

3.11 HANDICAP LAVATORY EXPOSED HOT WATER AND WASTE PIPING

- A. Shall be insulated with foamed plastic insulation or extruded polyethylene, one-half inch thickness.
- B. Mitre cut insulation to fit the pipe, fittings and stops.
- C. Use approved cement to seal all joints, seams, and end in the insulation.

END OF SECTION

## SECTION 221113 - WATER DISTRIBUTION PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SUMMARY

- A. This Section specifies the water distribution piping system, including potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building to a point 5 feet outside the building.

#### 1.3 DEFINITIONS

- A. Water Distribution Piping: A pipe within the building or on the premises which conveys water from the water service pipe or meter to the points of usage.
- B. Water Service Piping: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

#### 1.4 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. ASTM A 120-84 Specifications for pipe.
  - 2. ASTM B 88-83A Specifications for seamless copper water tube.
  - 3. ANSI B16.4 Fittings, Flanges, and Valves.
  - 4. ANSI B16.22 Fittings, Flanges, and Valves.
  - 5. ASSE 1003 and 1003-1 - Performance Requirements for Water Pressure Reducing Valves.
  - 6. AWWA C110-82 Standard for Fittings, Flanges, and Valves.
  - 7. AWWA C600 - Standard for Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances.
  - 8. AWWA C110-82 Standard for Gaskets.
  - 9. AWWA C601 - Standard for Disinfecting Water Mains.
  - 10. PDI WH-201 - Water Hammer Arresters.

11. Plumbing Code Compliance: Comply with applicable portions of BOCA Basic National Plumbing Code.

12. ASME Compliance: Fabricate and stamp pressure - Standards of these Organizations, the more stringent regulations shall govern.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pipe in a manner to prevent sagging and bending.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad. Concrete, reinforcement, and form work requirements are specified in Division 03.

B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.7 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer uniformity: Conform with the requirements specified in Basic Mechanical Requirements, under "Product Options."

B. Manufacturer: Subject to compliance with requirements, provide water distribution piping products from one of the following:

1. Balance Cocks:

- a. Bell & Gossett ITT; Fluid Handling Div.
- b. Taco, Inc.

2. Pressure Regulating Valves:

- a. Cash (A.W.) Valve Mfg. Corp.
- b. Spence Engineering Co., Inc.
- c. Watts Regulator Co.

3. Water Meters:

- a. Badger Meter, Inc.
- b. Rockwell Intl.; Municipal & Utility Div.
- c. Zurn Ind. Inc.; Hays Fluid Controls Div.

4. Relief Valves:

- a. Cash (A.W.) Valve Mfg. Corp.
- b. Watts Regulator Co.
- c. Zurn Ind., Inc.; Wilkins-Regulator Div.

5. Water Hammer Arresters:

- a. Amtrol, Inc.
- b. Tyler Pipe; Sub. of Tyler Corp.
- c. Zurn Ind., Inc.; Hydromechanics Div.

## 2.2 PIPE AND FITTINGS

A. Pipe Within Building (except below slab):

- 1. Pipe Sizes 2" and Smaller: Copper tubing. Conform to ASTM B88, Type L, hard temper, copper tube; ANSI B16.22 streamlined pattern wrought-copper fittings, with soldered joints using 95-5 tin-antimony solder.
- 2. Pipe Sizes Larger than 2": Galvanized steel pipe. Conform to ASTM A120, Schedule 40, seamless, galvanized steel pipe; with mechanical grooved pipe couplings and fittings.

B. Pipes Inside and Outside Building, Below Ground:

- 1. PVC plastic water pipe. Conform to AWWA C900, for Class 100, Polyvinyl chloride (PVC) water pipe;/ AWWA C110, for Class 100, cast-iron or ductile-iron fittings; mechanical joints.

## 2.3 VALVES

A. Gate Valves: Refer to Section 220523.

B. Balance Cocks:

- 1. Threaded Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.
- 2. Soldered Ends 2" and Smaller: Class 125, bronze body, bronze plug, screw driver operated, straight or angle pattern.

C. Piping Specialties:

1. Water Hammer Arresters: Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.
2. Basket Strainers: Cast-iron body, 125 psi flanges, bolted type or yoke type cover; with removable non-corrosive perforated strainer basket having 1/8" perforations and lift-out handle.
3. Flexible connectors: Stainless steel bellows with a woven flexible bronze wire reinforcing protective jacket; rated for 150 psig water working pressure, 250 degrees F operating temperature and suitable for up to maximum 3/4" misalignment. Connectors shall be a minimum of 12" long and have threaded or flanged ends; sweat ends are not acceptable.
4. Hose Bibbs: Bronze body, renewable composition disc, tee handle, 3/4" NPT inlet, 3/4" hose outlet.
5. Sill Faucets: Bronze body, with renewable composition disc, wheel handle, 3/4" solder inlet, 3/4" hose outlet.
6. Recessed Non-Freeze Wall Hydrants: Cast-bronze box, with chrome plated face, tee handle key, vacuum breaker, hinged locking cover, 3/4" inlet, and hose outlet. Bronze casing shall be length to suit wall thickness.
7. Pressure Regulating Valves: Single seated, direct operated type; having bronze body with integral strainer, and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.

D. Relief Valves:

1. Provide proper size for relief valve, in accordance with ASME Boiler and Pressure Vessel Codes, for indicated capacity of the appliance for which installed.
2. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 180 degrees F, and pressure relief at 100 psi.

2.4 WATER METER

- A. Water meter: Compound type, conforming to AWWA Standards. Size meter and arrange piping and specialties to comply with utility company requirements.

PART 3 - EXECUTION



### 3.1 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in requirements plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.
- C. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 JOINING PIPES AND FITTINGS

- A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.

### 3.3 PIPING INSTALLATION

- A. Refer to the separate Division 22 section: Basic Piping Materials and Methods, for general piping installation instructions.
- B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.
- C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement on, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- D. Install piping with 1/32" per foot (1/4 percent) downward slope towards drain point.

### 3.4 SERVICE ENTRANCE

- A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building.
- B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.
- C. Install shutoff valve at service entrance inside building; complete with strainer, pressure gage, and test tee with valve.
- D. Ductile-Iron Pipe: Install in accordance with AWWA C-60.

### 3.5 ROUGH-IN FOR WATER METER

- A. Install rough-in piping and specialties for water meter installation in accordance with utility company's instructions and requirements.

### 3.6 INSTALLATION OF VALVES

- A. Installation requirements for general duty valves are specified in a separate section of Division 22.
- B. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2" and smaller, use gate or ball valves; for sectional valves 2-1/2" and larger, use gate or butterfly valves.
- C. Shutoff Valves: Install shutoff valves on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated. For shutoff valves 2" and smaller, use gate or ball valve; for shutoff valves 2-1/2" and larger, use gate or butterfly valves.

### 3.7 INSTALLATION OF PIPING SPECIALTIES

- A. Install backflow preventers at each connection to mechanical equipment and systems, and in compliance with the plumbing code and authority having jurisdiction. Locate in same room as equipment being connected. Pipe relief outlet without valves, to nearest floor drain.
- B. Install pressure regulating valves with inlet and outlet shutoff valves, and balance cock bypass. Install pressure gage on valve outlet.

### 3.8 EQUIPMENT CONNECTIONS

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.
- B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide connection. For connections 2-1/2" and larger, use flanges instead of unions.

### 3.9 FIELD QUALITY CONTROL

- A. Inspections:
  - 1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
  - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform test specified below in the presence of the plumbing official.
    - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
    - b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the

requirements of the plumbing official.

- c. Reinspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange System Test:
3. Test for leaks and defects all new water distribution piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
4. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
5. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
6. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

### 3.10 ADJUSTING AND CLEANING

#### A. Cleaning and Disinfecting:

1. Purge all new water distribution piping systems and parts of existing systems, which have been altered, extended, or repaired prior to use.
2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction, or in case a method is not prescribed by that authority, the procedure described in either AWWA C601, or AWWA D105, or as described below:
  - a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
  - b. Fill the system or part thereof, with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system, or part thereof, and allow to stand for 24 hours.
  - c. Drain the system, or part thereof, of the previous solution, and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
  - d. Following the allowed standing time, flush the system with clean potable

water until chlorine does not remain in the water coming for the system.

- e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Reports:

- 1. Prepare reports for all purging and disinfecting activities.

END OF SECTION

## SECTION 221116 - PLUMBING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.
- B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 PIPING SPECIALTIES

- A. Where it is desirable or necessary to support the pipe hangers to concrete, inserts shall be placed in the forms by the Mechanical Contractor prior to the time concrete is poured.
- B. Lead tamp-ins may be used when installed in a concrete or masonry wall or other like vertical surface to support a vertical hanger. Lead tamp-ins will not be permitted to support hangers to the underside of concrete slab.
- C. For parallel runs of above ground suspended piping, an acceptable trapeze-type hanger may be used. Provide permanent, non-conductive type wrapping between copper pipe and steel trapeze hangers.
- D. Pipes passing through walls, floors shall have sleeves of the same materials as the pipe. Sleeves shall allow insulated pipes to pass without changing the insulation

thickness. Clearance around sleeves shall be packed with glass fiber after completion of pipe work. Sleeves in all floor slabs except slabs on grade shall have pipe sleeves extended 1 inch above finish floor to prevent water from running through sleeves to area below. Make watertight, caulk with sealant around each sleeve.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The contractor shall furnish all labor, materials, \*including gases\* equipment and instruments required to conduct tests of piping systems. Tests shall be as herein called for.
- B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.
- C. Tests shall be conducted and the inspection of the piping shall be made in the presence of the Architect and/or Engineers.
- D. Material and/or joints found defective shall be replaced and/or corrected and additional tests shall be conducted after correction of work.

### 3.2 PIPE SIZING, DRAWINGS AND SPECIFICATIONS

- A. It is intended that work covered by these specifications and drawings include everything requisite and necessary to make the various systems complete and operative, irrespective of whether or not every item is specifically provided for. Any omission of direct reference herein to any essential item shall not excuse contractor from complying with the above intent.
- B. Figured dimensions supercede scaled ones. Contractor shall take no advantage of, and shall promptly call the Owner's Representative's attention to any error, omission or inconsistency in specifications and drawings.
- C. Special attention is directed to requirements that equipment and materials stated in specifications and/or indicated on drawings shall be furnished, except if otherwise noted, completely installed, adjusted and left in safe and satisfactory operating condition. Accessories, appliances and connections necessary for operation of equipment shall be provided to satisfaction of the Owner's Representative.
- D. Materials, apparatus or equipment specified or otherwise provided for on drawings, addenda, or change orders issued subsequent to award of contract shall be same brand, type, quality and character originally specified unless otherwise provided.
- E. Layout of equipment, accessories, specialties and suspended, concealed or exposed piping systems are diagrammatic unless dimensioned. In preparing shop drawings, contractor shall check project conditions before installing work. If there are any

interferences or conflicts, they shall be called to attention of the Owner's Representative immediately for clarification.

- F. The drawings indicate required size and points of termination of pipes and ducts and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. However, it is not intended that drawings indicate all necessary offsets, and it shall be the work of this contractor to make the installation in such a manner as to conform to structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further obstruction or cost to the Owner.
- G. Shop drawings shall be furnished by this contractor, indicating all changes to meet space requirements, code requirements and as necessary to resolve all space conflicts.
- H. It is intended that all apparatus be located symmetrical with architectural elements, and shall be installed at exact height and locations as shown on the architectural drawings. Refer to architectural details in completing and correlating work.
- I. The contractor shall fully inform himself regarding any and all peculiarities and limitations of the spaces available for the installation of all work and materials furnished and installed under the contract, prior to submitting his bid. He shall exercise due and particular caution to determine that all parts of his work are made quickly and easily accessible.
- J. The contractor shall carefully examine any existing conditions, existing piping and ducts and premises and compare the drawing with the existing conditions, prior to submitting his bid.
- K. It cannot be too strongly emphasized that, except for work specifically excluded herein, every system shall be turned over to Owner installed completed, with components, ready for normal operation.
- L. In addition to work shown on mechanical drawings, see Architectural Drawings for existing work to be removed, relocated and/or modified. Modify existing systems by rerouting for systems to remain or remove the abandoned systems as required to accommodate new general construction, plumbing, electrical and mechanical work.
- M. Pipe sizes shall be minimum as allowed by local codes or as shown on the drawings, whichever is larger.

END OF SECTION

SECTION 221119 –  
DOMESTIC COLD & HOT WATER SUPPLY PIPING & HOT WATER CIRCULATING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

- A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.
- B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Provide valves and specialties as specified under additional Sections of this Specification.

2.2 PIPE

- A. The following schedule covers materials unless otherwise specified under a particular System Section.
  - 1. Galvanized steel pipe, Schedule 40, ANSI B 125.2.
  - 2. Copper tube, Type L, hard drawn, ASTM B 88.
  - 3. Brass pipe or tube, chrome plated.



## 2.3 FITTINGS

- A. Steel Pipe: Malleable iron 150 lb. banded, galvanized to match pipe.
- B. Copper Tube: Wrought or cast brass solder joint.
- C. The 'T' drill extruded fitting method may not be used.
- D. Service material shall be brass compression fittings-angle ball cocks, ball corporations, etc. Flared fittings are acceptable under controlled conditions.

## 2.4 PIPE JOINTS

- A. Joints in copper piping shall be made with tin-antimony solder (95-5) and non-acid flux. Contractor shall furnish manufacturers literature documenting that the lead content (trace quantities) are within the guidelines of the local codes having jurisdiction as well as the Safe Drinking Water Act Amendment (SDWAA).
- B. Joints in threaded piping shall be made with teflon tape or non hardening pipe compound (seal-tite).

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The design drawings are generally diagrammatic. They do not show every bend, offset, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work is necessary to avoid conflicts.
- B. Run all water lines parallel or perpendicular to building lines.
- C. For piping requiring insulation, lay out and carefully install piping with sufficient clearances to permit proper application of the insulation. If the piping is such that a neat insulation job cannot be obtained with reasonable effort, the piping subcontractor shall relocate piping.
- D. Separate underground water piping and building sewer with undisturbed or compacted earth at least 10' horizontally if installed at the same level or lower than the sewer. Where water piping is closer than 10' to a sewer, place the bottom of the water pipe at least 18" above the top of the sewer, or the sewer shall be encased in a concrete envelope as required by the Department of Health & Rehabilitative Services (State of Florida).
- E. Minimum cover for exterior underground piping is three feet over insulation or conduit unless otherwise noted on plans. Carefully excavate trench to smooth finished surface; if cut is too deep, backfill with clean earth and hand tamp to compact bottom. Make depression at joints to receive flanges, collars, and couplings.

Provide continuous support for pipe or conduit. Backfill to be clean earth, free of rocks and debris completely enveloping pipe or conduit on both sides and top to a minimum thickness of 6". Carefully hand tamp backfill in 6" layers until 24" has been deposited over pipe or conduit.

- F. Place color coded 6" wide 0.004" thickness polyethylene printed plastic identification tape directly above all underground piping systems approximately 12" below finished grade. Tapes shall be continuously printed with "CAUTION" in large bold letters. Printed second line with type of service below. Yellow tape is to be used for water, (Print type of water on tape; i.e., domestic cold water.)

### 3.2 HANGERS AND SUPPORTS

- A. Vertical Piping shall be supported at its base and no greater than every story height.
- B. Horizontal Piping (Suspended) shall be supported at not more than eight (8) foot intervals. Supports shall be adequate to maintain alignment and prevent sagging.
- C. Supports shall be connected to the building structure not from other equipment, ducts or conduits.

### 3.3 JOINTING PIPE

- A. All pipe lines shall be correctly aligned before joints are made.
- B. Squarely cut pipe and properly ream to remove all constriction and burrs before making up the joints.
- C. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound or tape on male threads only at each joint and tighten joint to leave not more than 3 threads exposed.
- D. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".
- F. Run water supply main to point indicated on plans.

### 3.4 AIR CHAMBERS

- A. 20 pipe diameters, but not less than 12". Provide at each fixture, risers and ends of supply lines.

### 3.5 WATER HAMMER ARRESTERS

- A. Water hammer arresters (shock stops) shall be installed at the locations on the plans and in accordance with PDI Standard WH-201. Provide access panels so located to permit ease of service.

### 3.6 VALVES

- A. Provide valves to isolate each riser, and branch line. See also Section 220523 for requirements.

### 3.7 REDUCERS

- A. Screwed bushings are prohibited, except where available space prevents use of reducing couplings. Pipe reductions on horizontal, hot water piping shall be made with eccentric reducers. Top of hot water piping shall be flat for venting.

### 3.8 TESTS

- A. Apply a water pressure test to all parts of the water supply system before the piping is concealed and before the fixtures and equipment are connected. Use a hydrostatic pressure of not less than 100 psig or 150% of system operating pressure, applied to the system for a period of four hours. There shall be no leaks at any point in the system at this pressure.
- B. Leave concealed work uncovered until required tests have been completed, but if necessary, make tests on portions of the work and those portions of the work may be concealed after being inspected and approved. Make repairs of defects that are discovered as a result of inspection or tests with new materials. Caulking, welding or other such sealing methods of screwed joints, cracks or holes will not be accepted. Repeat tests after defects have been eliminated.
- C. Complete all field testing prior to insulation, wrapping and/or backfill.

### 3.9 STERILIZATION

- A. As soon as the water piping has been thoroughly flushed out, sterilize the lines by introducing into them a solution of calcium hypochlorite or chloride of lime. Open and close all valves while system is being chlorinated. After the sterilizing agent has been applied for 24 hours, test for residual chlorine at the ends of the lines. If less than 10 parts per million is indicated, repeat the process. When tests show at least 10 parts per million of residual chlorine, flush out the system until all traces of the chemical used are removed. Make necessary connections to sterilized piping.

### 3.10 PIPE PROTECTIONS

- A. Paint all uninsulated piping underground with two coats of asphaltic paint. (Manual wiping is not acceptable)

- B. Wrap pipe that touches metal or is exposed to masonry with a layer of 6 mil polyene film or 15 lb. felt.
- C. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt.
- D. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate. Remove pipe thread lubricants prior to applying paint.

END OF SECTION

## SECTION 221123 - DOMESTIC WATER BOOSTER PUMP

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install booster pump system including all valves, fittings and by pass.
- B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

#### 1.5 MANUFACTURERS

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products complying with the requirements of this Section and the installation requirements of the plans are acceptable.

### PART 2 - PRODUCTS

#### 2.1 PUMPS

- A. Horizontally mounted close coupled, bronze fitted, end suction centrifugal pumps with mechanical seals and bronze wear rings.

#### 2.2 MOTORS

- A. Motors shall be NEMA standard, ball bearing, industrial quality and furnished with drip-proof enclosures.

#### 2.3 HYDRO-PNEUMATIC TANK

- A. Internal reservoir type, 170 gallon, ASME 200 psi tank. Supplied with pressure switch and circuit to shut off lead pump during low flow conditions.

## 2.4 VALVES AND PIPING

- A. Suction and discharge headers shall be fabricated of flanged schedule 40 seamless pipe, hot dip galvanized after fabrication. System shall be furnished with full lug style butterfly valves, Clayton 90-01 PRV'S, non-slam wafer check valves, liquid filled gauges, control tubing with shut-off cocks and Metraflex flexible connectors at each header.

## 2.5 CONTROLS

- A. The control panel shall be a NEMA 3R UL labeled panel, mounted and wired for additive pump sequence, continuous lead pump, 3 pump manual alteration, supplied with low suction pressure safety shut- down, pilot lights, HOA switches, control transformer, disconnect, fuse blocks and pump sequencing controls. Control panel shall sequence pumps via pressure transducer with led readout of actual system pressure. Each pump shall be controlled by a digital, solid state control board with all pressure and minimum run time delays field adjustable.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install booster pump system as indicated on the drawings, in accordance with manufacturer's installation instructions and in compliance with applicable codes.
- B. Set booster pump system level and plum on a 4" high concrete pad and orientated so controls and devices needing service and maintenance have adequate access.
- C. Booster pump system shall be prepiped and prewired to single point service connections from the manufacturer.
- D. Connection to domestic water piping system with dielectric unions, isolation shutoff valves and a by pass.
- E. Complete instructions covering installation and operation of the booster pump system shall be provided in booklet form. All components shall be identified, in exploded views, by individual part number. Complete start-up service shall be performed by the manufacturer's representative.
- F. Subsequent service and stocking of spare parts shall be available from a local authorized dealer.

END OF SECTION

## SECTION 221316 - SANITARY SEWER, STORM WATER & SANITARY VENT PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. The work pertaining to this Division occurs within the confines of the building line, and within a boundary outside of the building line for a distance of five (5) feet, measured normal to the building line, or as indicated on the drawings.
- B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 MATERIAL

- A. The following schedule covers materials unless otherwise specified under a particular System Section.

#### 2.2 PIPE

- A. Cast-iron soil pipe service weight, centrifugally cast, ANSI A112.5.1. 2" Through 15" size, bell and spigot joint.
- B. Cast-iron soil pipe service weight, centrifugally cast, ANSI A112.5.1. 1-1/2" through 10" size, "non-hub" joint.
- C. Reinforced concrete pipe (RCP) 12" through 144" bell and spigot pattern with O-ring rubber gaskets, ASTM C76.

- D. Copper type DWV.
- E. Brass pipe or tube, chrome plated.
- F. PVC Type DWV, ASTM D2665-78. 1-1/2" through 6" size.

## 2.3 PIPING APPLICATIONS

- A. For above ground soil waste and vent piping, use any of the following materials:
  - 1. Cast iron soil pipe service weight "NO-HUB" joints.
  - 2. Copper type DWV.
  - 3. Brass pipe or tube, chrome plated. This shall be provided for all above ground p-traps. PVC p-traps are not acceptable.
  - 4. PVC type DWV, ASTM D2665-78.
- B. For below ground soil waste and vent piping, use any of the following materials:
  - 1. Grease line: Cast iron soil pipe service weight bell and spigot. PVC shall not be acceptable.
  - 2. Sanitary waste:
    - a. Cast iron soil pipe service weight bell and spigot.
    - b. PVC type DWV, ASTM D2665-78. (Note: In HVAC plenums, PVC piping shall not be installed.)
  - 3. Storm (Refer to size limitation in Section 2.2):
    - a. Cast iron soil pipe service weight bell and spigot.
    - b. PVC type DWV, ASTM D2665-78.
    - c. Reinforced concrete pipe.

## 2.4 FITTINGS

- A. Cast-Iron Soil Pipe:
  - 1. Underground: Provide fittings of same weight and manufacture as pipe in which installed. Joints shall be bell and spigot push-on type neoprene gasket or "NO HUB" type conforming to CIPI Standard 301 unless noted otherwise on drawings.
  - 2. Above ground and in buildings: "NO-HUB" type conforming to CIPI Standard 301 unless noted otherwise on the drawings.
- B. Threaded Drainage Pipe: Cast-iron, recessed.



- C. Copper DWV: Cast or wrought solder joint DWV drainage fittings.
- D. PVC Type DWV: ASTM D-2665, NSF Seal of Approval, Solvent-cement joint.

## 2.5 PIPE JOINTS

- A. Bell and spigot type joint shall be made with push-on compression type, neoprene gasket conforming to ASTM A-74.
- B. No-hub type joints shall be constructed of 24 gage type 304 stainless steel, with gasket guides, type 304 stainless steel screw clamp, and matching neoprene (ASTM C-564) gasket that shall interlock with housing.
- C. Joints in copper piping shall be made with tin-antimony solder (95-5) silver solder and non-acid flux.
- D. Joints in threaded piping shall be made with teflon tape or non hardening pipe compound (Seal-tite).

## 2.6 VENT FLASHING

- A. Furnish 4 lb. lead flashing, material as recommended by roofing system manufacturer, or copper pitch pans for all vents through the roof. Type of flashing used shall be compatible with piping material.

## 2.7 IDENTIFICATION

- A. Below grade piping identification and warning tape shall be 0.004 inch thick polyethylene, printed with a continuous two line message. Tapes used for non magnetic piping materials shall have a metallic core. Acceptable manufacturer is Seton Name Plate Corporation or approved equal.
- B. Above ground piping identification tape shall conform to ANSI and ASME A13.1 2007.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. The design drawings are generally diagrammatic. They do not show every bend, offset, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work is necessary to avoid conflicts.
- B. PVC piping, fittings and other PVC materials shall not be installed in air conditioning plenums or equipment rooms used as air conditioning plenums.
- C. Joints and connections shall be made permanent and watertight.

- D. Run piping to sewer connection point outside of building or as indicated on drawings.
- E. Install 3" and larger horizontal soil and waste piping to 1/8" per foot slope. Piping 2" and smaller shall be installed at a slope of 1/4" per foot. Run horizontal vent lines to a minimum grade back to stacks and vertical vent lines as direct and free from bends as possible.
- F. For piping requiring insulation, lay out and carefully install piping with sufficient clearances to permit proper application of the insulation. If the piping is such that a neat insulation job cannot be obtained with reasonable effort, the piping subcontractor shall relocate piping.
- G. Separate underground water piping and building sewer with undisturbed or compacted earth at least 10' horizontally if installed at the same level or lower than the sewer. Where water piping is closer than 10' to a sewer, place the bottom of the water pipe at least 18" above the top of the sewer, or the sewer shall be encased in a concrete envelope as required by the Department of Health & Rehabilitative Services (State of Florida).
- H. Minimum cover for exterior underground piping is three feet over conduit unless otherwise noted on plans. Carefully excavate trench to smooth finished surface; if cut is too deep, backfill with clean earth and hand tamp to compact bottom. Make depression at joints to receive bells, collars, and couplings. Provide continuous support for pipe or conduit. Backfill to be clean earth, free of rocks and debris completely enveloping pipe or conduit on both sides and top to a minimum thickness of 6". Carefully hand tamp backfill in 6" layers until 18" has been deposited over pipe or conduit.
- I. Place color coded 6" wide 0.004" thickness polyethylene printed plastic identification tape directly above all underground piping systems approximately 12" below finished grade. Tapes shall be continuously printed with "CAUTION" in large bold letters. Printed second line with type of service below. Red tape is to be used for sewer, (Print type of water on tape; i.e., storm water.)
- J. Where condensate piping is indicated, piping shall be extended to the nearest catch basin/yard drain. A cast iron back water valve shall be provided with epoxy-coated steel access housing.

### 3.2 HANGERS AND SUPPORTS

- A. Vertical Piping shall be supported at its base and no greater than every story height, not to exceed 20 foot intervals.
- B. Horizontal Piping (Suspended) shall be supported at each bend; at not more than five (5) foot intervals; except that pipe exceeding five (5) feet in length may be supported at not more than ten (10) foot intervals. Supports shall be adequate to maintain alignment and prevent sagging and shall be made directly behind the bell or coupling, where possible, not near the center of the pipe.

- C. Supports shall be connected to the building structure not from other equipment, ducts or conduits.
- D. Horizontal pipe and fittings six inches and larger shall be suitably braced to prevent horizontal movement. This should be done at every branch opening or change of direction by the use of braces, blocks, rodding or other suitable method, to prevent movement.
- E. Where components are suspended in excess of eighteen inches by means of non-rigid hangers, they should be suitably braced against movement horizontally, often called sway bracing.

### 3.3 LINE AND GRADE

- A. Install gravity lines at uniform grade to low point after field verification of low point invert.
- B. Run piping straight, plumb and grade in the direction indicated on the drawings.

### 3.4 JOINTING PIPE

- A. All pipe lines shall be correctly aligned before joints are made.
- B. Squarely cut pipe and properly ream to remove all constriction and burrs before making up the joints.
- C. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound on male threads only at each joint and tighten joint to leave not more than 3 threads exposed.
- D. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply non-acid solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Joining "NO-HUB" cast iron soil pipe and fittings shall be in accordance with recommended practices described by the coupling manufacturers.
- F. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".
- G. Provide reducing fittings (reducing bushings shall not be used) where changes in pipe sizes occur.
- H. Provide dielectric unions or flanges between copper and steel piping and between brassware and steel. Do not use steel and copper piping in the same system without such isolation.

### 3.5 PIPE PROTECTION

- A. Paint all uninsulated piping underground (except cast iron) with two coats of asphaltic paint (Manual wiping is not acceptable).
- B. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mil polyene film or 15 lb. roofing felt.
- C. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. roofing felt.

### 3.6 TESTS

- A. A water test shall be applied to the sanitary and storm drainage systems either in its entirety or in sections. If applied to the entire system, all openings in the piping shall be tightly closed, except the highest opening and the system filled with water to point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, but no section shall be tested with less than 10 ft. head of water. In testing successive sections at least the upper 10 ft of the next preceding section shall be tested, so that no joint or pipe in the building (except the uppermost 10 ft of the system) shall have been submitted to a test of less than a 10 ft head of water. The water shall be kept in the system, or in the portion under test, for at least 30 minutes before inspection starts; the system shall then be tight at all points.
- B. An air test shall be made by attaching an air compressor or testing apparatus to any suitable opening and after closing all other inlets and outlets to the system, forcing air into the system until there is a uniform gauge pressure of 5 psi or sufficient to balance a column of mercury ten inches in height. This pressure shall be held without introduction of additional air for a period of at least 30 minutes.
- C. Complete all field testing prior to insulation, wrapping and/or backfill.

### 3.7 VENT FLASHING

- A. Extend lead type flashing 12" beyond pipe in all directions and carry to top of pipe with at least 2" return inside of pipe.
- B. Install PVC pipe flashing in accordance with flashing manufacturer's recommendation.
- C. Flashing for PVC piping shall be installed in accordance with manufacturer's instructions.
- D. Install flashing materials as required by roofing system manufacturer's details and methods.

END OF SECTION

## SECTION 221317 - CLEANOUTS AND CLEANOUT ACCESS COVERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.
- B. Alternates may be or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.2 SCOPE

- A. Furnish and install cleanouts as shown on drawing or specified herein.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Cleanouts and cleanout access covers shall be of the type and materials as scheduled on the drawings.
- B. Provide all necessary bolts and appurtenances to effect a complete installation.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install all cleanouts and cleanout access covers in accordance with the manufacturers instructions.
- B. Exterior cleanouts below grade shall be extended to finish grade. Pour a concrete pad 18" x 18" x 6" thick around cleanout; slope top down approximately 2" from cleanout to edge of pad so that edge of pad is flush with grade.

- C. Cleanouts shall be of the same nominal size as the pipes to which they are connected up to 4" in diameter; and not less than 4" for larger pipes.
- D. Cleanouts shall be provided at not more than 50 feet apart in horizontal drainage lines of 4" nominal diameter, and at not more than 75 feet apart for larger diameter pipe.
- E. At change in direction: Cleanouts shall be provided at each change of direction of the building drain when the angle of change is 90 degrees.
- F. At base of stacks: Cleanouts shall be provided at or near the base of each vertical stack.
- G. Direction of cleanout: All cleanouts shall be installed so that the cleanout opens in a direction opposite to the flow of the drainage line, or at a right angle to the line.
- H. Concealed cleanouts in wall shall be provided with removable access panel.
- I. Where access cleanout boxes or covers are installed in the floor, the top surface shall be scoriated and the cover secured, but removable when necessary. Polished brass. Install carpet type covers in carpeted areas.

END OF SECTION

## SECTION 221319 - FLOOR DRAINS AND SHOWER DRAINS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install floor drains and shower drains including strainers and trap primers.
- B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 DRAINS

- A. Drains shall be of the type and materials as scheduled on the drawings.
- B. Provide all necessary bolts, clamping rings and appurtenances to effect a complete installation.
- C. The strainer size shall be as recommended by the manufacturer unless otherwise indicated on the drawings. The strainers shall be nickel alloy or polished brass. Provide tapped boss and trap primer floor drains as indicated on the drawings.

#### 2.2 TRAP PRIMERS

- A. Provide for all floor drains.
- B. Units shall be cast bronze, with removable top cover, threaded or sweat pattern, and integral vacuum breaker.

C. Acceptable manufacturers are: Wade, Josam, Smith, MIFAB and Zurn.

## 2.3 SHOWER PANS

- A. Shower pans shall be constructed from lead. Sheet lead shall be 6-pound weight, except that 4-pound sheet lead may be used for each pan installed without joints or seams other than corner seams.
- B. Shower pans shall be constructed of polyethylene concealed chlorinated waterproofing membrane; nominal 0.040-inch thickness, equal to chloraloy. All joints and/or seams shall be welded tight with CPE (non plasticized chlorinated polyethylene) solvent bonding liquid or xylene.

## PART 3 - EXECUTION

### 3.1 DRAINS

- A. Install all drains in accordance with the manufacturer's instructions.

### 3.2 TRAP PRIMERS

- A. Trap primer outlet should extend vertically a minimum of 12" before a change in direction to horizontal is made. The horizontal line to the trap primer connection shall be installed sloping to the trap it serves. Provide a minimum size of 12" x 12" stainless steel access cover for each trap primer.

### 3.3 SHOWER PANS

- A. The floor of each individual shower, the shower area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curbing or partition shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing not less than eight inches for turn-up on walls or partitions, and shall be folded over the curb with an approximate return of one-fourth of curb height. The upstands shall be placed behind any wall or partition finish. Shower pans shall be clamped to drain as specified herein. After installation of the pan and the finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 4 inches at curb areas and 1 inch without curbs for a period of 24 hours. Any drop in the water level during the test, except for evaporation, shall be reason for rejection, repair and retest.
- B. When a shower pan of required size cannot be furnished in one piece, the separate metal pieces shall be joined with a flat-lock seam and soldered or burned. The corners shall be folded tight, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated inside and outside with one brush



coat of roofing asphalt. Asphalt shall be applied evenly at not less than one gallon per 50 square feet. The joining surfaces of metal pan and drain shall be given a brush coat of roofing asphalt after the pan is connected to the drain.

- C. When a shower pan of required size cannot be furnished in one piece, the separate pieces shall be joined with solvent bonding liquid. The corners shall be folded tight, not cut, and the corner seam shall be sealed.

END OF SECTION

## SECTION 221321 - DRAINAGE AND VENT SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SUMMARY

- A. This Section specifies building sanitary and vent piping systems.
- B. Related Sections:
  - 1. Separate sections in Division-02 specify sanitary sewage systems, and trenching and backfilling.
  - 2. Separate sections in Division-07 specify flashing and sheet metal and joint sealers.
  - 3. Division-23 Basic Mechanical Requirements section applies to the work of this section.
  - 4. Separate sections of Division-22 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system requirements, pipe insulation, and plumbing equipment.

#### 1.3 DEFINITIONS

- A. Drainage System: Includes all the piping within a public or private premises which conveys sewage or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.
- B. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and back pressure.

#### 1.4 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. Plumbing Code Compliance: Comply with applicable portions of the Florida Building Code.

## 1.5 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of flashing and roof penetrations.
- B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.
- C. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.
- D. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturer Uniformity: Conform with the requirements specified in Basic Mechanical Requirements.
- B. Drainage Piping Specialties, including expansion joints, drains, trap primers, and vandal-proof vent caps:
  - 1. Josam Mfg. Co.
  - 2. Zurn Ind., Inc; Hydromechanics Div.
  - 3. Wade Division, Tyler Pipe

### 2.2 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

- A. Hubless cast-iron soil pipe: Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310.
- B. Rain water leader piping above grade may be PVC meeting AWWA C900 Class 100. Joints shall be mechanical using elastomeric gaskets. Use of PVC in return air plenums (ie, office area) and through fire rated assemblies will not be permitted.

### 2.3 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

- A. Pipe sizes 15" and smaller: Cast-iron soil pipe. Conform to ASTM A74, for Extra-Heavy weight, hub-and-spigot soil pipe and fittings, with neoprene compression gasket joints conforming to ASTM C564. Pipe and fittings shall have a heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

### 2.4 DRAINAGE PIPING SPECIALTIES

- A. Trap Primers: Bronze body valve with automatic vacuum breaker, with ½" connections matching piping system, complying with ASSE 1018.

- B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.
- C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.
- D. Floor Cleanouts: Cast-iron body and frame, with clean-out plug and adjustable round top as follows:
  - 1. Nickel-Bronze Top: Manufacturer's standard cast unit with a standard non-slip scored or abrasive finish.
  - 2. Cast-iron Top: Manufacturer's standard cast unit with a standard non-slip scored or abrasive finish.
- E. Wall Cleanouts: Cast-iron body adaptable to pipe with cast-bronze or brass cleanout plug; stainless steel cover including screws.
- F. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.
- G. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.
- H. Floor Drains:
  - 1. Floor drain type designations and sizes are indicated on Drawings; See fixture schedules.
- I. Roof Drain:
  - 1. Roof drain type designations and sizes are indicated on the drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping

and specialties are to be installed.

- E. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 JOINING PIPES AND FITTINGS

- A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.
- B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hubless joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

### 3.3 INSTALLATION

- A. Refer to the separate Division-22 section: Basic Piping Materials and Methods, for general piping installation instructions.
- B. Install supports and anchors in accordance with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors".
- C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-yses, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- E. Make joints of "No-Hub" cast iron soil pipe with coupling assembly using torque wrench pre-set at 60 inch pounds.
- F. Install Thrust blocks at the bottom of the waste stack, condensate stack and rain leader pipe.
- G. Install sleeve and mechanical sleeve seal through foundation wall for watertight installation.

### 3.4 INSTALLATION OF PIPING SPECIALTIES

- A. Install expansion joints on vertical risers as indicated and as required by the plumbing code.
- B. Above Ground Cleanouts: Install in above ground piping as indicated:
  - 1. As required by plumbing code.
  - 2. At each change in direction of piping greater than 45 degrees.
  - 3. At minimum intervals of 50' for piping 3" and smaller, 75' piping 4" and larger.
  - 4. At base of each vertical soil or waste stack.
- C. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping, types as indicated.
- D. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.
- E. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

### 3.5 INSTALLATION OF TRAP PRIMERS

- A. Install trap primers with piping pitched towards drain trap, minimum of 1/8" per foot (1 percent). Adjust trap primer for proper flow.

### 3.6 CONNECTIONS

- A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

### 3.7 FIELD QUALITY CONTROL

- A. Inspections:
  - 1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
  - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
    - a. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.

- b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
- 3. Reinspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for reinspection by the plumbing official.

### 3.8 PIPING SYSTEM TEST

- A. Test for leaks and defects all new drainage and vent piping systems.
- B. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
- C. Drainage and Venting System Testing Procedures:
  - 1. Rough Plumbing: Test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
  - 2. Finished Plumbing: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
- D. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

### 3.9 ADJUSTING AND CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

### 3.10 PROTECTION

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION



## SECTION 221426 - ROOF DRAINS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install roof drains including underdeck clamps and gravel guards as indicated on drawings.
- B. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Drains shall be of the type and materials as scheduled on the drawings.
- B. Provide all necessary bolts, clamping rings and appurtenances to effect a complete installation.
- C. Roof drain bearing pan where required shall be by roof drain manufacturer.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install all drains in accordance with the manufacturer's instructions.
- B. Drain bodies required to be insulated shall be installed with sufficient clearances and accessibility to permit proper installation of the insulation material.

END OF SECTION

## SECTION 221600 - NATURAL GAS PIPING SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install a complete natural gas piping system including all piping, regulators, connections to equipment and appurtenances. Work shall start with the connection on the downstream side of the gas meter.
- B. All work shall be in full compliance with local gas utility requirements.
- C. Alternates may be or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Provide valves and specialties as specified under other sections of these Specifications.

#### 2.2 PIPE

- A. The following schedule covers materials unless otherwise specified under the particular System Section.
  - 1. Material: Black steel pipe, Schedule 40, ANSI B 125.2

## 2.3 FITTINGS

- A. Make joints and connections permanent and watertight.
  - 1. Threaded Steel Pipe: Malleable iron 150 lb. banded, black to match pipe.
  - 2. Interior piping 1-1/2" and larger shall be welded black steel. Piping 1-1/4" and smaller shall be black steel, threaded, malleable fittings.
- B. Underground piping shall be seamless welded steel constructed in accordance with ASTM A53 or A106.
- C. Underground piping shall be factory coated with an extruded plastic coating for steel pipe. Coating shall consist of high density polypropylene copolymer. Application of coating shall be pinhole free. Field joints shall be made with thermofit pipe sleeves, with installation as per manufacturer's recommendations. Coating and sleeves shall be Standard X-Tru-Coat as manufactured by General Steel Industries, Inc. or approved equal.
- D. Provide reducing fittings where changes in pipe sizes occur. (Reducing bushings shall not be used).
- E. Coat all exposed threads on steel pipe after assembly with two coats of zinc chromate.
- F. Provide either malleable iron or brass ground joint unions for pipe 2" in diameter or smaller. Piping 2-1/2" and larger shall be black steel with flanged connections.

## 2.4 DIELECTRIC UNIONS

- A. Provide dielectric unions or flanges between copper and steel piping and between brassware and steel. Do not use steel and copper piping in the same system without such isolation.
- B. Wrap pipe that touches metal or is exposed to masonry with a layer of 6 mil polyethylene film or 15 lb. felt.
- C. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt.

## 2.5 GAS REGULATORS

- A. At each point where a gas line enters a building, that line shall be equipped with a pressure reducing regulator to reduce gas pressure to seven inches water column before the building entry. Such regulators shall be equipped with a high outlet pressure shut off device requiring manual reset sized to interrupt gas flow if the outlet pressure exceeds set pressure by fourteen (14) inches water column. Regulators should be capable of delivering the required gas volume with 5 psig inlet pressure and seven inch water column outlet pressure and shall be rated for a minimum sixty

(60) psig inlet working pressure. Fisher types S-105 and S-205 or S-207 or approved equal type regulator shall be used.

- B. Provide auxiliary gas pressure regulators at each equipment location for gas distribution system pressures greater than 2 psig. Regulators shall be capable of delivering the required gas volume with a seven inch water column outlet pressure.

## 2.6 EMERGENCY SHUTOFF VALVE

- A. Gas emergency shut off valve (3/4" to 3" IPS) shall be aluminum body threaded pattern with Buna N Disc solenoid type with free reset handle to shut off the fuel gas instantly upon de-energization of electric power. The free handle will not open the valve until the solenoid is energized which will allow the lever to engage. Then the lever can be manually raised to the latched position, opening the valve. The valve will trip closed instantly when the solenoid is de-energized.
- B. Manual reset movement shall be heavy-duty sealed unit with a highly visible position indicator showing valve position. Top movement can be rotated to any of 4 positions (90 degrees apart) to best locate the handle and visual indicator.
- C. Valve shall be equal to Automatic Switch Company (ASCO) catalog number series 8044A1 through 8044A7, for AC only electrical connection.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The design drawings are generally diagrammatic. They do not show every bend, offset, elbow or other fitting which may be required in the piping for installation in the space allotted. Careful coordination of the work of this Section with that of other trades is necessary to avoid conflicts.
- B. Sleeves: Provide for pipes passing through walls, floors and roof before placing concrete.
- C. All gas piping shall be installed in strict accordance with the requirements of the local gas company and the American Gas Association rules and regulations.
- D. All gas lines run underground inside of the buildings and under concrete slabs outside of the buildings shall be sealed to prevent the possible entrance of any gas leakage. The conduit shall extend at least four inches outside the building and be vented above grade to atmosphere with a gooseneck or vent cap to prevent the entrance of water. Both ends of conduit under paved areas shall be vented with goosenecks or vent caps.
- E. The encasement conduit shall be PVC, plastic coated, or approved type of corrosion resistant piping materials. The encasement conduit shall be of sufficient size to permit the removal of the gas piping for repair or replacement.

- F. All gas lines installed underground beneath pavement i.e., walkway, drive and parking area shall be in a similar manner to piping underground beneath building floors except that all ends of the conduit shall extend a minimum of 6" beyond the edge of the pavement with both ends sealed and vented.
- G. Lines run in concealed but accessible construction need not be installed in a protective conduit but shall be labeled in accordance with other sections of this Specification.
- H. Dirt Pockets: Run distribution system with a pitch down to dirt pockets. Full line size, a 12" minimum nipple with a screw cap at the bottom.
- I. Make connections between equipment furnished by others or under other Sections of the Specifications to the piping systems provided under this Section of the Specifications.
- J. Make connections between any piece of equipment and any piping system in this Section of the Specifications by means unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance. Provide dirt pocket as described in paragraph "Dirt Pockets" above.
- K. Install valves or cocks in supply lines to each piece of equipment on supply side of union connection.
- L. Test all piping of the gas system with air at 50 psig, maintained for a period of one hour. After installation, test the piping and tubing to all appliances at not less than normal operating pressure to prove them free of leaks.
- M. All welding shall be performed by a certified welder.

### 3.2 JOINTING PIPE

- A. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound "Tite-Seal" on male threads only.
- B. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".
- C. Welded joints in underground pipe shall be wrapped and coated with materials recommended by pipe coating manufacturer.
- D. Bevel pipe ends at a 37.5 degree angle, smooth rough cuts, and clean to remove slag, metal particles and dirt.
- E. Install welding rings for butt welded joints.
- F. Use pipe clamps or tack-weld joints with 1" long welds; 4 welds for pipe sizes to 10".

- G. Build up welds with stringer-bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.
- H. Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.
- I. At Installer's option, install forged branch-connecting fittings wherever branch pipe is indicated; or install regular "T" fitting.
- J. At Installer's option, install forged branch-connection fittings wherever branch pipe of size smaller than main pipe is indicated; or install regular "T" fitting.
- K. All welds shall be performed by a certified welder.

### 3.3 TESTING

- A. Complete all field testing prior to wrapping or backfilling.

END OF SECTION

## SECTION 223330 - DOMESTIC WATER HEATERS, RESIDENTIAL ELECTRIC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install water heater including all valves, fittings, overflow drain pan, relief valve, heat trap and appurtenances.
- B. Alternates may be or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

### PART 2 - PRODUCTS

#### 2.1 WATER HEATER

- A. Water heater shall be constructed with steel tank constructed to 150 PSI working pressure, 300 PSI test pressure and lined with borosilicate glass bonded to tank. Glass lining to be baked at 1600°F to assure a molecular-interchange between tank and lining. Tank to be protected against electrolytic activity with replaceable factory installed anode rod and factory installed dielectric nipples.
- B. Water heater to be provided with fully adjustable temperature controls and automatic high limit control. Unit shall have A.S.M.E. approved temperature and pressure relief valve properly sized for BTU capacity of the unit installed.
- C. Water heater shall be insulated to ASHRAE 90-1980A standards and jacketed with manufacturer's standard heavy steel jacket.
- D. Water heater shall also feature 98% efficient immersion type heating elements. Tin coated, copper sheathed elements shall be provided. All units shall be constructed



with factory installed heat traps to increase efficiency and reduce stand-by loss by a minimum of 10%.

- E. All units to be U.L. tested and U.L. listed for service as a domestic water heater for voltage inputs of 120V, 208V, 240V or 480V.
- F. Water heater shall carry a limited factory warranty of 5 years. Owner to be provided with copy of warranty and operations manuals as distributed by manufacturer.

## 2.2 WATER HEATER SAFETY PAN

- A. Provide galvanized steel (24 gage min.) or other corrosion resistant material plastic or PVC accepted metal safety pan with a minimum depth of 1-1/2 inches and of sufficient size and shape to receive all drippings and/or condensate from the water storage tank or heater. The pan shall be drained by an indirect waste pipe no less than one (1) inch in diameter or the diameter of the outlet of the required relief valve(s) whichever is larger.
- B. The pan drain shall extend full-size and terminate over a suitably located indirect waste receptor or floor drain or extend to the exterior of the building and terminate no less than six (6) inches or more than twenty-four (24) inches above grade.
- C. When the discharge from the relief valve(s) is to be discharged into the safety pan, it shall be piped full-size of the valve outlet pipe size to a point not more than two (2) inches or no less than one (1) inch above the pan flood level rim.
- D. The discharge from the relief valve shall be piped full-size separately to the outside of the building or to another approved terminal as provided for safety pan drain terminals but in no case shall the discharge from a relief valve be trapped.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Provide gate valves on both the incoming cold water and leaving hot water supply piping.
- B. Cold water supply shall also be equipped with a check valve down stream of the gate valve. Remove flapper from check valve and drill a 1/16 inch hole in flapper. Replace flapper in valve body.
- C. Provide unions to facilitate replacement of the storage tank and/or heater.
- D. Heat trap shall be installed in the hot water supply piping.

END OF SECTION

## SECTION 223405 - DOMESTIC WATER HEATERS: COMMERCIAL ELECTRIC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install water heater including all valves, fittings, overflow drain pan, relief valve, heat trap and appurtenances.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

#### 1.5 MANUFACTURERS

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Lochinvar
  - 2. State Industries
  - 3. A. O. Smith
  - 4. Ruud

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Water heater shall be of size, voltage and wattage as shown on drawings. Tank shall be 300 p.s.i. test pressure, 150 p.s.i. W.P. approved; glass lined, with 1.315 dia. "Dow" magnesium tank saver. Elements will be copper sheath, tin coated immersion type, low watt density (75 watts p.s.i. maximum). Tank shall be insulated to ASHRAE 90A-1980 energy efficiency standards. Heater jacket shall be heavy gauge steel with baked enamel finish. Internal wiring shall be composed of solid copper

wire having an insulation material rated at 600 V, 200 C. Heater shall have a factory installed temperature and pressure relief valve.

B. Control Circuit:

1. Surface Mounted Thermostats: Individual thermostats with built-in manual reset hi limit providing staged control and over-temperature protection for each heating element.
2. Immersion Thermostats: Supplied with one magnetic contactor for each 18 KW increment. 120 volt control circuit with built in transformer.

C. Water heater shall be U.L. listed and approved and shall be fused in accordance with U.L. requirements.

D. Water heater to be size voltage and wattage as shown on drawings. Heater to be completely insulated and jacketed for (vertical) or (horizontal) installation. The jacket shall be rectangular 16-gauge galvanized steel with beige acrylic enamel finish. Jacket shall have a full-length hinged access door with key lock. Tank insulation shall be high-density fiberglass sufficient to meet ASHRAE 90A-1980 standards of 4 watts per square foot of tank surface maximum energy loss. Key lock door provides additional safety and security.

E. Tank construction shall be 300-pound test. 125-pound working pressure and be ASME stamped and National Board listed. All tanks are to be lined with vitreous glass, fired at 1600 F. provided molecular interchange of glass and steel. Manhole cleanout shall be standard on 500 through 2500 gallon models.

F. Handhole cleanout on heaters under 500 gallons heater shall include the following standard features: internal fusing for control and load circuits, built-in safety drain pan with piping connections, low-watt density incoloy sheath elements, ASME rated temperature and pressure relief valve, terminal block wiring, 180°F water temperature approval, U.L. listing, 3 year limited warranty.

G. Control system: Individual thermostats with built in manual reset hi limit providing staged control and hi-limit safety for each heating element. (Not available on horizontal models) -OR-

H. Magnetic contactors with immersion thermostat: 120 volt control with built in transformer.

I. The discharge from the relief valve shall be piped full-size separately to the outside of the building or to another approved terminal as provided for safety pan drain terminals but in no case shall the discharge from a relief valve be trapped.

J. Provide magnesium storage tank savers.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Provide gate valves on both the incoming cold water and leaving hot water supply piping.
- B. Cold water supply shall also be equipped with a check valve down stream of the gate valve. Remove flapper from check valve and drill a 1/16 inch hole in flapper. Replace flapper in valve body.
- C. Provide unions to facilitate replacement of the storage tank and/or heater.
- D. Heat trap shall be installed in the hot water supply piping.

END OF SECTION

## SECTION 224000 - PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.
- B. Related Sections:
  - 1. Separate grab bars and toilet accessories not an integral part of plumbing fixtures are specified in Division-10.
- C. This Section specifies plumbing fixtures and trim. The types of fixtures specified included the following:
  - 1. Lavatories (including wheelchair type);
  - 2. Service Sinks;
  - 3. Water Closets;
  - 4. Urinals;
  - 5. Mop Basins;
  - 6. Drinking Fountains;
  - 7. Faucets;
  - 8. Flush Valves;
  - 9. Fixture Supports (including wheelchair type);
  - 10. Toilet Seats;
  - 11. Electric Water Heater;

#### 1.2 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration Systems."
  - 2. ARI Standard 1010: "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers."
  - 3. ANSI Standard A117.1: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People."
  - 4. Public Law 90-480: "Architectural Barriers Act of 1968."
  - 5. UL Standard 399: "Drinking-Water Coolers."

B. Delivery, Storage, and Handling:

1. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.
2. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

C. Sequence and Scheduling:

1. Schedule rough-in installations with the installation of other building components.

1.3 MAINTENANCE

A. Extra Stock:

1. Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer uniformity shall be as specified in Section 230500: Basic Mechanical Requirements under Product Options.

1. Subject to compliance with specified requirements, provide plumbing fixtures of one of the following:

a. Lavatories, Service Sinks, Water Closets, Urinals, Bath Tubs:

- (a) Toto.
- (b) Franke
- (c) Eljer Plumbingware Div.; Household International Co.
- (d) Kohler Co.
- (e) American Standard.

b. Faucets:

- (a) Delta
- (b) Elkay
- (c) Chicago Faucet Co..
- (d) Eljer Plumbingware Div.; Household International Co.
- (e) Kohler Co.

c. Flush Valves:

- (a) Sloan Valve Co.
- (b) Zurn Industries, Inc.; Hydromechanics Div.

d. Water Closet Seats:

- (a) Bemis Mfg. Co.
- (b) Beneke Corp.

e. Water Coolers:

- (a) Elkay Mfg. Co.
- (b) Filtrine Manufacturing Co.
- (c) Haws Drinking Faucet Co.

f. Service Sinks:

- (a) Crane Co.
- (b) Eljer Plumbingware Div.; Household International Co.
- (c) Kohler Co.

g. Fixture Supports:

- (a) Josam Mfg. Co.
- (b) Kohler Co.
- (c) Zurn Industries, Inc.; Hydromechanics Div.

2.2 FIXTURES (See schedule)

2.3 WATER COOLERS (See schedule)

2.4 FAUCETS (See schedule)

2.5 FLUSH VALVES (See schedule)

2.6 FIXTURE SUPPORTS (See schedule)

2.7 ELECTRIC WATER HEATER (See schedule)

2.8 FITTINGS, TRIM AND ACCESSORIES

- A. Toilet Seats: elongated, solid white plastic, closed back/open front, less cover, and having stainless steel check hinge and replaceable bumpers.

2.9 ESCUTCHEONS

- A. Chrome-plated cast brass with set screw.

PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Do not proceed until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- B. Comply with the installation requirements of ANSI A111.1 and Public Law 90-480 with respect to plumbing fixtures for the physically handicapped.
- C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- D. Set shower receptor and mop basins in a leveling bed of cement grout.
- E. Install a stop valve in an accessible location in the water connection to each fixture.
- F. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.
- G. Seal fixtures to walls and floors using silicone sealant as specified in Section 079200. Match sealant color to fixture color.

### 3.3 FIELD QUALITY CONTROL

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.
- B. Inspect each installed unit for damage. Replace damaged fixtures.

### 3.4 ADJUSTING

- A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.
- B. Replace washers of leaking or dripping faucets and stops. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.



### 3.5 CLEANING

- A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

### 3.6 PROTECTION

- A. Provide protective covering for installed fixtures, water coolers, and trim.
- B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

### 3.7 ROUGH-IN SCHEDULE (Refer to Drawings)

### 3.8 MOUNTING HEIGHTS SCHEDULE

<u>Fixture</u>	<u>Mounting Height</u>
Water Closet	15" floor to rim
Wheelchair Water Closet	18" floor to rim
Standard Urinals	22" floor to rim
Adult Standard Water Cooler	40" floor to rim
Wheelchair Water Cooler	35" floor to rim
Adult Standard Drinking Fountains	40" floor to rim
Wheelchair Drinking Fountain	35" floor to rim

END OF SECTION

## SECTION 224005 - PLUMBING FIXTURES AND TRIM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install plumbing fixtures indicated on drawings or specified herein.
- B. All plumbing fixtures shall be "First Quality" as defined and set forth in Commercial Standard CS77-28 as promulgated by the U.S. Department of Commerce. All fixtures are to be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.
- C. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instruction under this section of the specifications.
- D. Fixtures and fittings proposed shall be from one manufacturer and of similar character in any room or location. Escutcheons, handles, etc., on the different fixtures shall be of the same design.
- E. The fixture numbers and types are scheduled on the drawings, and are used to indicate type and quality of fixtures desired. Acceptable fixture manufacturers are as follows: American Standard, Eljer and Kohler. Fixture manufacturers not listed herein will be considered subject to the general requirement outlined in Section 230100 General Mechanical Provisions.
- F. Alternates may or may not substantially change scope and general character of the work; and must not be confused with "change orders", "substitutions", and other similar provisions.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SUBMITTALS

- A. Submit manufacturer's data for review before any work is commenced.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Flush valves and water closet seats shall be as scheduled on the drawings.
- B. All exposed metal not otherwise specified shall be polished chromium on brass or bronze. All supply valves shall have renewable seats and discs. All hot and cold water supply to fixtures shall be provided with stops. Provide P-trap with cleanout for each lavatory and sink except as specifically noted.
- C. All seats shall be solid, white, open front seat with checking and self sustaining, stainless steel hinge.
- D. Chair carriers and combination chair carriers and fittings shall be as scheduled on the drawings.
- E. Chrome-plated. Provide where exposed piping passes through finished surfaces. Escutcheons for extended sleeves shall be of the type designed for that purpose.
- F. Provide a concealed hanger type lavatory chair carrier with short foot mounted in the chase to support lavatories shown on walls of a chase.
- G. Provide through toggle bolts, 1/8" thickness steel backing plate, and wall hangers for support of lavatories on 6" or thicker concrete block walls.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Layout fixtures as indicated on the drawings.
- B. Carefully install fixtures in accordance with manufacturer's data with sufficient clearances to coordinate with accessories, specialties and equipment specified in other divisions of these specifications and/or as shown on the drawings.
- C. Hangers and carriers shall be installed in accordance with manufacturer's recommendations and in accordance with good practice and workmanship.
- D. Clean all exposed metal surfaces from grease, dirt, paint or other foreign material.
- E. Fixtures shall be properly protected from damage during construction and shall be cleaned in accordance with manufacturer's instruction under this section of the specification.
- F. Fixtures, chrome-plated piping, fittings and trim shall be polished before requesting acceptance of the system.

END OF SECTION

## SECTION 230100 - GENERAL MECHANICAL PROVISIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE OF DIVISION

- A. Work shall include all materials, equipment and labor necessary for a complete and properly functioning mechanical installation in accordance with all applicable codes, and contract drawings and specifications. Work shall include all work specified in Division-22, Plumbing and Division-23, HVAC.
- B. Pay for all required licenses, fees, inspections and permits.

#### 1.3 RELATION TO OTHER WORK

- A. Work Not in Divisions 22 and 23: Related work not included in this division consists of requirements given in the following as may be included in the contract documents:
  - 1. Other divisions which may include work (such as concrete, steel, painting, ceiling systems, structure and other work) related to the work of Divisions 22 and 23.
- B. Work of Divisions 22 and 23: Any or all sections of Divisions 22 and 23 may include a paragraph or paragraphs under the heading, "Relation to other Work". Where such a paragraph is indicated and work directly related to the section is listed or described, such work shall be considered as relating directly to the indicated section. Any related work (directly related or otherwise) which may be omitted by reference from the "Relation to Other Work" paragraph of such section(s), shall be provided as necessary and required whether or not such work is included by reference. Such listing or description of related work within a section is given only as a convenience to the Contractor; omission of other related sections or described work does not in any way exclude the provision of such work.

#### 1.4 CODES

- A. Install all work in accordance with the latest edition of all applicable regulations and governing codes, including the regulations of the utility companies serving the project.
- B. Where a conflict in code requirements occurs the more stringent requirement shall govern.

#### 1.5 STANDARDS

- A. All equipment and devices shall bear U.L. label, the label of an industry recognized approved testing agency or A.G.A. certification for said item of equipment or device.
- B. All electrical devices must be U.L. approved.

#### 1.6 DRAWINGS

- A. Architectural and structural drawings take precedence over mechanical drawings with reference to the building construction. Mechanical drawings are diagrammatic and indicate the general arrangement and extent of work. Architectural drawings indicate more exactly the desired relationship between diffusers, registers, lighting fixtures, equipment, electric panels and devices, plumbing fixtures, and other items which remain exposed in the completed building. Exact locations and arrangement of materials and equipment shall be determined, with the acceptance of the Architect/Engineer, as work progresses to conform in the best possible manner with the surroundings and with the adjoining work of other trades. Where locations of equipment, devices or fixtures are controlled by architectural features, establish such locations by referring to dimensions on Architectural drawings and not by scaling drawings.

#### 1.7 DISCREPANCIES

- A. In case of differences between drawings and specifications, or where drawings and specifications are not clear or definite, the subject shall be referred to Architect/Engineer for clarification and instructions.

#### 1.8 ELECTRICAL PROVISIONS

- A. Work of Divisions 22 and 23 shall include the electrical requirements which are indicated to be integral with mechanical work and which can be summarized to include (but not necessarily be limited to) the following:
  - 1. Motors.
  - 2. Motor starters.
  - 3. Wiring from mechanical equipment to electrical work termination (junction box or disconnect switch).
  - 4. Control switch, pilot lights, interlocks and similar devices.
  - 5. Electrical heating coils and similar elements in mechanical equipment.
  - 6. Electrical work specified in Division-23 for the HVAC control system.
  - 7. Drip pans to protect electrical work.
- B. Motors, Starters, Switches: Provide with all motorized mechanical equipment unless otherwise indicated.

- C. Drip Pans: Where possible, do not run mechanical piping directly above electrical (or electronic) equipment which is sensitive to moisture; otherwise provide drip pans under mechanical piping. Locate pan below piping, and extend 6" on each side of piping and lengthwise 18" beyond equipment. Fabricate pans 2" deep, of reinforced sheet metal with rolled edges and soldered or welded seams; 20 gage copper, or 16 gage steel with 2 oz. zinc finish hot dipped after fabrication. Provide 3/4" copper drainage piping, properly discharged.
- D. Motors: Unless specifically specified otherwise in the section covering the driven equipment (or the equipment drives), motors shall comply with the following:
1. Three Phase: NEMA design B, three-phase, squirrel cage induction type designed for 1800 rpm synchronous speed for operation in 40°C ambient at 1.15 service factor at constant speed on the scheduled voltage. Motors shall be insulated with Class B insulation material and shall be cast iron, drip proof, horizontal foot mounted type with ball bearings. Two speed motors shall be provided as scheduled and shall be two winding type.
  2. Single Phase: Squirrel cage induction type designed for 1800 rpm synchronous speed for operation in 40°C ambient at 1.15 service factor at constant speed on the scheduled voltage. Motors shall be insulated with Class B insulation materials and shall be two winding capacitor start type with steel enclosure, drip proof, horizontal foot mount and ball bearings.
  3. Electric motors which are designated to be high efficiency type shall also comply with the section describing high efficiency motors.
- E. Scheduled Horsepower: The horsepower scheduled or specified are those nominal sizes estimated to be required by the equipment when operating at specified duties and efficiencies. In the case of pumps, these horsepower are non-overloading and may also include provisions for future planned impeller changes. If the actual horsepower for the equipment furnished differs from that specified or shown on the drawings, it shall be the Contractor's responsibility to insure that proper size feeders, breakers, starters, etc. are provided at no change in contract price.
- F. Any TEFC motors shall have Class F insulation.
- G. Drip proof protected motors shall have Class B insulation.
- H. Manufacturer: Electric motors, complying with the requirements of this Section and the installation and performance requirements of the plans, by the following manufacturers are acceptable:
1. Reliance Electric
  2. Gould Electric
  3. General Electric
  4. Westinghouse

## 1.9 ELECTRICAL/MECHANICAL WORK

A. Definitions: Definitions for the purpose of mechanical/electrical control and power coordination are as follows: (Note: The use of the words, "Provide", "furnish" and "install" are intended only for use in describing the coordination indicated by this paragraph and do not necessarily have the same definitions when used outside of the context of this paragraph.) Any items which do not fall within the scope of this paragraph shall be coordinated as individually specified.

1. "Furnish" means to procure an item and to deliver it to the project for installation.
2. "Install" means to determine (in coordination with others as necessary) the appropriate intended location of an item and to set and connect it in place.
3. "Provide" means to both furnish and install.
4. Power Circuit: Circuit which carries main electric power to apparatus to which the power circuit is connected.
5. Control Circuit: Circuit which carries electrical signals directing the performance of a controller but which does not carry the main electric power. (See NEC, Section 430-71.) Such circuits shall also include those which serve a dual control and power function (e.g., a line voltage thermostat circuit which both activates and powers a small fan motor).
6. Controller: A device, or group of devices, which serves to govern, in some predetermined manner, electric power delivered to apparatus to which the controller is connected and includes any switch or device normally used to start and stop a motor. (See NEC, Article 100, Definitions, "Controller", and Section 430-81(a).)
7. Control Device: A device which reacts to an operating condition (pressure, temperature, flow, humidity, etc.) and which initiates transmission of an electrical control signal which causes operation of a controller or which causes operation of pressure switches, etc.
8. Auxiliary Control Device: A device (such as a low voltage control transformer, electric relay, etc.) which is located in a control circuit and which carries or responds to (but does not initiate) an electrical control signal initiated by a control device.

B. Work of Division-23 includes (but is not necessarily limited to):

1. Provide:
  - a. All controllers which are generally manufactured or shipped as integral with Division-23 equipment (such as starters packaged with air cooled chillers, etc.).



- b. All electric motors and other electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.) which are specified in Division 22 or 23.
- c. All control circuits (including conduit and boxes) from the Division-26 panels to point of use including the necessary circuit breakers.
- d. All other control circuits, including conduit and boxes.
- e. All control connections to equipment.
- f. All control connections to controllers, switches, motors and other mechanical systems electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.).
- g. Auxiliary control devices.
- h. All control devices (thermostats, pressure switches, flow switches, humidistats, etc.) and make control circuit connections thereto.
- i. Any and all pneumatic and electronic and electric control devices and electric or pneumatic connections thereto.

2. Furnish:

- a. All controllers which are generally manufactured and/or shipped as separate but companion items to Division-23 equipment (such as centrifugal chiller starters which are matched with the chillers but are not physically an integral part of the chiller assembly.)

C. Work of Division-26 includes (but is not necessarily limited to):

1. Provide:

- a. All power circuits, including conduit and boxes.
- b. All power connections to controllers, switches, motors and other mechanical systems electrical power consuming equipment (such as electric air heating coils, electric boilers, electric hot water heaters, etc.).
- c. All remote motor disconnects (remote from the related controller) at all locations required by NEC and connections thereto except those disconnects which are specified in Division-23 to be provided as part of the equipment itself.
- d. All controllers (except those which are generally manufactured or shipped as separate but companion items to Division-23 equipment such as centrifugal chiller starters).

2. Install:

- a. All controllers which are generally manufactured and/or shipped as separate but companion items to Division-23 equipment (e.g., chiller starters).

1.10 AUXILIARIES AND ACCESSORIES

- A. Include all auxiliaries and accessories for complete and properly operating systems.

1.11 INVESTIGATION OF SITE

- A. Check site and existing conditions thoroughly before bidding. Advise Architect/Engineer of discrepancies or questions noted before bidding.

1.12 ASBESTOS

- A. Should asbestos, or any other hazardous waste material, be encountered during the execution of the work, or should the presence of asbestos or any other hazardous material be suspected, immediately notify the Owner and suspend all work in the affected area. The Owner will activate an assessment study to determine the presence of asbestos, or other hazardous material, and evaluate what condition it is in. Removal of asbestos, or other hazardous material, if required, will be conducted by a qualified Contractor, and will be done under separate contract.

1.13 COORDINATION

- A. Provide all required coordination and supervision where work of this division connects to or is affected by work of others.

1.14 PROVISIONS FOR OPENINGS

- A. Provide all openings required for work performed under Division-23. Provide sleeves or other approved methods to allow passage of items installed under any Section of Division-23.

1.15 INTERRUPTION OF EXISTING SERVICES

- A. Any interruption of existing services shall be coordinated in advance with the Owner's Representative. Shutdown time and duration of critical services shall be decided by the Owner. Contractor shall provide shutoff valves at point of tie-in to minimize downtime.

1.16 CLEANING AND PROTECTION

- A. Ductwork: Keep the interior of the duct system free from dirt and rubbish and other foreign matter. All fan motors, switches, and other items, shall also be protected from dirt, rubbish and other foreign matter during building construction. Thoroughly clean all components of the ductwork and remove all dirt, scale, oil and other foreign substances which may have accumulated during the installation process.

- B. Equipment: All mechanical equipment provided shall be thoroughly cleaned of all dirt, oil, concrete, etc. Any dents, scratches or other visible blemishes shall be corrected and the appearance of the equipment made "like new" and to the satisfaction of the Architect/Engineer.
- C. Upon completion, and before final acceptance of the work, all debris, rubbish, leftover materials, tools and equipment shall be removed from the site.
- D. Protection of Work Until Final Acceptance: Protect all materials and equipment from damage, entrance of dirt and construction debris from the time of installation until final acceptance. Any materials and equipment which are damaged shall be repaired to "as new" condition or replaced at the direction of the Architect/Engineer. Where factory finishes occur and damage is minor, finishes may be touched up. If, in the opinion of the Architect/Engineer the damage is excessive, factory finish shall be replaced to "new" condition.

#### 1.17 SHOP DRAWINGS

- A. Submit shop drawings for all items, services and systems included in the project.
- B. Shop drawings shall clearly show the following:
  - 1. Technical and descriptive data in detail equal to or greater than the data given in the item specification. Indicate all characteristics, special modifications and features. Where performance and characteristic data is shown on the drawings or specified, submitted data shall be provided in a degree which is both quantitatively and qualitatively equal to that specified and shown so that comparison can be made. Present data in detail equal to or greater than that given in item specification and include all weights, deflections, speeds, velocities, pressure drops, operating temperatures, operating curves, temperature ranges, sound ratings, dimensions, sizes, manufacturers' names, model numbers, types of material used, operating pressures, full load amperages, starting amperages, fouling factors, capacities, set points, chemical compositions, certifications and endorsements, operating voltages, thicknesses, gauges and all other related information as applicable to particular item.
  - 2. Exceptions to or deviations from the contract documents. Should Architect/Engineer accept any items having such deviations which are not clearly brought to Architect/Engineer's attention, in writing, on item submittal, then Contractor is responsible for correction of such deviations regardless of when such deviations are discovered.
- C. Additional Requirements: See specific sections of the Specifications for any additional requirements.

#### 1.18 SHOP DRAWINGS TECHNICAL INFORMATION BROCHURE

- A. Submit within thirty days after Notice to Proceed. Each brochure shall consist of an adequately sized, hard-cover, 3-ring binder for 8-1/2" x 11" sheets. Provide correct designation on outside cover and on spine of binder, i.e., mechanical. All shop drawings shall be submitted at one time; partial submittals will not be accepted.
- B. First sheet in the brochure shall be a photocopy of the "Division-23 Index" for these specifications. Second sheet shall be prepared by the Contractor and shall list Project addresses for this Project for Contractor and all major subcontractors and suppliers.
- C. Provide reinforced separation sheets tabbed with the appropriate specifications section reference number and typed index for each section.
- D. Shop drawing technical and descriptive data shall be inserted in the brochure in proper order on all items. Mark the appropriate specification section or drawing reference number in the right hand corner of each item. Provide complete information, including, but not limited to, wiring and control diagrams, scale drawings showing that proposed substitute equipment will fit into allotted space (indicate all service access, connections, etc.), test data, and other data required to determine if equipment complies fully with the specifications. All typewritten pages shall be on contractor or equipment manufacturer printed letterhead.
- E. At the end of the brochure, provide and insert a copy of the specifications for Division-23 and all addenda applicable to this Division.
- F. Submit not less than six brochures. Provide separate tag marking on an individual copy for the Owner, Architect, Engineer, Contractor, Subcontractor (two copies).
- G. Contractor shall review the brochure before submitting. Submittal information on each item in each brochure shall bear the Contractor's stamp of approval, initials of checker and date checked by him. No request for payment of or substitutions will be considered until brochure has been reviewed by the Contractor and submitted for checking.

#### 1.19 SHOP DRAWINGS FOR PIPING SYSTEMS AND DUCT SYSTEMS

- A. Shop drawings for piping systems and duct systems shall be done on reproducible transparencies and shall be of sufficient scale to verify clearances and equipment locations. Shop drawings shall show all required maintenance and operational clearances required. Cost of shop drawing preparation and reproduction shall be borne by the Contractor. Title drawings shall include identification of project and names of Architect, Engineer, Contractor, subcontractor and/or supplier, date, be numbered sequentially and shall indicate the following:
  - 1. Architectural and structural (as required) backgrounds with room names and numbers, etc., including but not limited to plans, sections, elevations, details, etc.

- a. Fabrication and Erection dimensions.
  - b. Arrangements and sectional views.
  - c. Necessary details, including complete information for making connections with other work.
  - d. Kinds of materials and finishes.
  - e. Descriptive names of equipment.
  - f. Modifications and options to standard equipment required by the contract.
  - g. Leave blank area, size approximately 4 by 2-1/2 inches, near title block (for Engineer's shop drawing stamp imprint).
- B. In order to facilitate review of drawings, insofar as practicable, they shall be noted, indicating by cross reference the contract drawings, note, and/or specification paragraph numbers where item(s) occur in the contract documents.
- C. Also provide shop drawings, using sepias of the architectural reflected ceiling plans, which indicate locations of the following (to be verified by Contractor): Air distribution devices, sprinkler heads, lights and access panels.
- D. See specific sections of specifications for further requirements.

#### 1.20 AIR HANDLING UNIT AND DUCTWORK CONFIGURATION SHOP DRAWINGS

- A. Contractor shall submit a shop drawing for each air handling unit. Such shop drawings shall meet the following requirements:
- 1. Be drawn at not less than a scale of 1/4" = 1'-0". Contractor may elect to use a larger scale if he desires (i.e., if drawing of unit is at 1/4" = 1'-0", 1/2" = 1'-0" may be used.).
  - 2. Clearly show all proposed ductwork configuration changes (sizes, routing, and similar differences) which are different in any respect from the Drawings. Extent of shop drawings shall show all ductwork to and from each unit beginning with and terminating at those points where ductwork is intended to remain unchanged as shown on Drawings.
  - 3. Where proposed changes affect any other work such as structure, housekeeping pads, piping, equipment, electrical work or any other work, shop drawings shall clearly show those proposed changes.
  - 4. Proposed changes shall be at no additional change in contract price.
  - 5. Where Drawings show units in plan only, shop drawings shall show proposed units in plan and also in elevation.

6. Shop drawings shall also show exact locations of related work (such as bar joists, columns, beams, sound attenuators, and like items) which affect the proposed ductwork routing and unit location and configuration.
  7. Each section of each air handling unit shall be clearly identified (i.e., coil section, fan section, filter section, mixing box section, etc.).
- B. Failure to submit these shop drawings together at the same time with the air handling unit shop drawings will result in total disapproval of the proposed air handling units. Time delays or other reasons will not be considered.

#### 1.21 ELECTRONIC FILES

- A. CADD files will be available on a limited basis to qualified firms at the Architects prerogative. The cost of the files will be \$100 per sheet. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions. These files are not intended to be used as shop drawings.
1. A request for CADD files should be delivered in writing along with payment for such files. Files will not be processed until payment is received.

#### 1.22 OPERATING INSTRUCTIONS

- A. Submit for checking a specific set of written operating instructions on each item which requires instructions to operate. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe operating instructions.

#### 1.23 MAINTENANCE INFORMATION

- A. Submit for acceptance Maintenance Information consisting of manufacturer's printed instruction and parts lists for each major item of equipment. After acceptance, insert information in each Technical Information Brochure. Refer also to other sections which may describe maintenance.

#### 1.24 MANUFACTURER'S CHECK-OUT

- A. Check out by Manufacturer's Representative (for major items of equipment): At completion of construction and after performance verification information as above-mentioned has been gathered, submitted and accepted, provide one copy of this information to the manufacturer's representative. Work required under this section shall include having the representative examine the performance verification information, check the equipment in the field while it is operating, and sign a Check-Out Memo for record. Submit a copy of the memo on each major item of equipment for each brochure. Accepted memos shall be inserted on each brochure with the performance verification information and submittal data. Memos shall be submitted

and accepted before Instruction in Operation to Owner or a request for final inspection.

#### 1.25 SYSTEM GUARANTEE

- A. The work required under Division-23 shall include a one year guarantee. This guarantee shall be by the Contractor to the Owner to replace for the Owner any defective workmanship, equipment, or material which has been furnished under this Contract at no cost to the Owner for a period of one year from the date of acceptance of the System. This guarantee shall also include reasonable adjustments of the system required for proper operation during the guarantee period. Explain the provisions of guarantee to Owner at the "Instruction in Operation Conference".

#### 1.26 INSTRUCTION TO OWNER

- A. Submit all required items for checking one week before final inspection of the building is scheduled. When all items are accepted and placed in the proper brochures, the Contractor shall give notice in writing that he is ready to give the Owner an "Instruction in Operation Conference". After the above mentioned request is received the Contractor will be notified of the time the conference can be held with the Owner. At the conference, the Contractor shall review with the Owner all appropriate information. At the end of the conference, seven copies of a memo certifying Instruction in Operation and Completed Demonstration shall be signed by the Contractor, Subcontractor and Owner and one copy inserted in each brochure.

#### 1.27 MATERIALS AND EQUIPMENT

- A. Each bidder represents that his bid is based upon the materials and equipment described in this division of the specifications.
  - 1. Submittal shall include the name of the material or equipment for which it is to be substituted, substituted equipment model numbers, drawings, cuts, performance and test data and any other data or information necessary for the Architect/Engineer to determine that the equipment meets all specification and requirements. If the Architect/Engineer accepts any proposed substitutions, such acceptance will be set forth in writing.
  - 2. Substituted equipment with all accessories installed or optional equipment where permitted and accepted, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether accepted or not, shall be replaced at the Contractor's expense. Any modifications of related systems of this or other trades as a result of substitutions shall be made at the Contractor's expense, and Contractor shall so state in his written request for substitution.

#### 1.28 ACCEPTABLE MANUFACTURERS

- A. Acceptable Manufacturers: Materials and Equipment specified in these contract documents are accepted only in regards to general performance and quality. It shall be the Contractor's responsibility to insure that acceptable materials and equipment

meet or exceed the efficiencies, capacities, electrical characteristics, performance and quality of the equipment herein specified. Acceptable equipment must also generally conform, without extensive modification of related systems to the accessories, weights, space and maintenance requirements, etc., of the specified equipment. Any modification to related systems of this or other trades shall be made at the Contractor's expense and the Contractor shall be responsible for coordination between trades. Any difference in capacity, efficiency, electrical characteristics, weights or quality of product, etc., between specified materials and equipment and acceptable alternates shall be submitted to the Architect/Engineer for acceptance within 30 days of Notice to Proceed.

## PART 2 - PRODUCTS

2.1 Section part not applicable.

## PART 3 - EXECUTION

3.1 Section part not applicable.

END OF SECTION



## SECTION 230500 - BASIC MECHANICAL MATERIALS AND METHODS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section, in addition to the following:

#### 1.2 SCOPE

- A. Materials listed herein are general mechanical materials to be used under the Division 22 and 23 sections of the specifications unless specifically noted otherwise in the particular section or on the drawings.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 22 and 23 and to all other applicable portions of the Drawings and Specifications. This section relates to all sections of Division 23 as may be applicable to the work of each section.

#### 1.4 STANDARDS

- A. Quality and weight of materials shall comply with requirements and specifications of the appropriate standards of the American Society of Testing and Materials.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT, GENERAL

- A. All materials and equipment shall be new and without blemish or defect.
- B. Equipment and materials shall be products which will meet with the acceptance of the agency inspecting the work. Where acceptance is contingent upon having the products examined, tested and certified by Underwriters Laboratory or other recognized testing laboratory, the product shall be so examined, tested and certified.
- C. Where no specific indication as to the type or quality of material or equipment is indicated, a standard item or system shall be furnished with all options, features and capabilities to meet the project requirements.
- D. Performance and Capacity:
  - 1. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In some cases equipment may be sized to

allow for future requirements or for other reasons which may not be stated on the Drawings or in the Specifications; provide equipment and systems with the capacities, capabilities and features indicated to provide the maximum or minimum (as appropriate) conditions.

E. Operating conditions and capacities must be as follows:

1. No overloading.
2. No operation at conditions outside of maximum and minimum limits recommended by the manufacturer and accepted by the Architect/Engineer.
3. Compatible with all systems.

F. Unless otherwise specified, all equipment and materials furnished must be as follows:

1. Recommended by the manufacturer for the application.
2. Installed in accordance with the manufacturer's recommendations for the application except where specifications and drawings clearly indicate otherwise.

## 2.2 ACCESS DOORS AND PANELS

- A. Locations: Provide access doors and panels (access units) as necessary for access to items which are concealed and which may require service or maintenance or other reason for accessibility. Examples of such items include, but are not limited to, the following: valves, cleanouts, pipe unions, expansion joints and connectors, dampers, coils, junction boxes, duct heaters, terminal units, HVAC control system devices and similar types of items.
- B. Access units: Shall be manufactured by the Milcor Division of Inland-Ryerson, Boico, Nystrom or Ventfabrics. Types are as follows (Milcor style designations are used for example only):

<u>Location</u>	<u>Door/Panel Type</u>
Drywall	Style "DW"
Masonry or tile	Style "M-stainless"
Acoustical tile	Style "AT"
Plaster	Style "K"
Fire-rated walls	Style "Fire Rated"***
(**or as indicated below)	

C. Fire Rated Units:

1. Frame and panel assembly shall bear a U.L. label reading, "frame and door assembly, rating 1-1/2-hour (B), temperature rise 30 minutes 250°F maximum".

2. Have an automatic closing device and mechanism to release the latch bolt from the inside.
3. Acceptable Manufacturers: Boico Style F, Inryco/Milcor Style VA, Nystrom Style APFR.

D. Non-fire Rated Units:

1. Steel panels and frames.
2. Locks and latches shall be as appropriate for the location and shall be cam-lock type latches, flush screw driver operated locks or cylindrical locks.
3. Provide two keys for all doors. All doors shall be keyed the same.

E. Other Requirements:

1. Doors and panels installed in glazed or ceramic tiled surfaces, in toilet rooms or in kitchens shall be stainless steel.
2. Unless otherwise indicated, finish shall be rust inhibitive prime coat.

F. Sizes:

1. Minimum size: 8" x 8".
2. Sizes of each unit shall be individually selected to allow the recommended and required service and maintenance and accessibility functions to be accomplished. These functions shall generally include, for example, valve removal, damper linkage resetting, control adjustment, lubrication, repair, replacement and similar tasks as may be necessary and recommended for the concealed item.
3. Sizes shall be of the following increments (unless otherwise approved) to allow the accessibility function to be accomplished: 8" x 8", 8" x 12", 12" x 12", 12" x 16", 16" x 16", 16" x 24", 24" x 24", 24" x 36", 30" x 30", 36" x 36" or 36" x 48".
4. No size smaller than 16" x 24" shall be allowed when a person must pass through the access opening in order to accomplish the desired accessibility function.
5. Every attic or furred space in which mechanical equipment is installed shall be accessible by an opening and passageway as large as the largest piece of the equipment and in no case less than 22 x 36 inches continuous from the opening to the equipment and its controls. The opening to the passageway shall be located not more than 20 feet from the equipment measured along the center line of such passageway.

## 2.3 PAINTING AND MARKING

- A. All paint and materials used for painting shall be manufacturer's "first quality" product. For additional paint material requirements, refer to Section 099101, Painting.
- B. Marking: Refer also to sections describing identification of mechanical systems.

## 2.4 PIPE HANGERS AND SUPPORTING DEVICES

- A. General: Refer to other sections of Division 23 for any requirements which may be additional to this section. Comply with the more stringent requirement if more than one method is specified or shown.
- B. Pipe supporting devices specified herein shall apply to all Division 22 and 23 piping unless modified in subsequent sections of Division 22 and 23 (ie., vibration isolation) or detailed on the drawings.
  - 1. Pipe hangers for copper pipe shall be copper or copperplated and for steel pipe shall be zinc-plated, clevis type hangers.
  - 2. Hangers for pressure piping shall be clevis type or accepted as equivalent. Pipe hangers shall be capable of vertical adjustment after erection of the piping. Piping shall not be hung from fire and/or smoke walls.
  - 3. Vertical piping supports shall be constructed of carbon steel with rounded ears and two or four holes for clamping bolts. Steel, galvanized and cast iron piping riser clamps shall have galvanized finish. Copper and brass piping riser clamps shall have electro-plated copper or PVC coating finish.
  - 4. Acceptable Manufacturers are Grinnell, PHD Manufacturing Inc., Fee and Mason, Michigan and Elcen.
- C. Beam clamps may be used when supporting piping from steel structures.
- D. Concrete inserts shall be placed in forms as work of Division 22 and 23 prior to the time that concrete is poured.
- E. Lead tamp-ins may be used when installed in a concrete or masonry wall or other like vertical surface to support a vertical hanger. Lead tamp-ins will not be permitted to support hangers to the underside of a concrete slab.
- F. For parallel runs of above ground suspended piping, an acceptable trapeze-type hanger may be used. Provide permanent, non-conductive type wrapping between copper pipe and steel trapeze hangers.
- G. Powder set type fasteners or inserts shall not be used.

## 2.5 FLOOR, WALL OR CEILING PLATES OR ESCUTCHEONS IN EXPOSED AREAS

- A. Shall be chrome-plated. Escutcheons for extended sleeves shall be of the type designed for that purpose. Split ring escutcheons will not be allowed.
- B. Escutcheons to be as manufactured by Guarantee Specialty Mfg. Co., Cleveland, Ohio; American Sanitary Mfg. Co., Abingdon, Ill., or Beaton Cadwell.
- C. Provide escutcheons or fabricated plates or collars at each location where pipe or duct passes through a finished surface. Escutcheons for flush sleeves shall be equivalent to Benton & Caldwell No. 3A chromium plated brass; for sleeves extending above floor shall be equivalent to Benton & Caldwell No. 36 chrome plated brass. Collars or plates for ducts and large diameter insulated pipe shall be fabricated of 18 gage galvanized copper bearing sheet steel, secured to structure and neatly fitted around duct or pipe.

## 2.6 SLEEVES

- A. General: Lay out work and set sleeves in new or existing construction so that minimum cutting, drilling and patching is required. Seal all sleeves not used during construction period with grout. Seal unused penetrations and sleeves through fire rated barriers to prevent passage of smoke and heat using an Underwriters' Laboratories approved method; sealing method must be rated at least equivalent to the barrier being penetrated. Submit proposed method to show proof of UL approval.
- B. Pipe Sleeves, Special Considerations: The following conditions require pipe sleeves as indicated:
  - 1. Where subject to hydrostatic pressure: Sleeves installed in walls and floors subject to hydrostatic (water) pressures shall be "Link Seal" (Thunderline Corp) Type WS or accepted as equivalent.
  - 2. Where piping is existing: When fire rated walls are to be erected where there is existing piping, provide Proset fire rated split wall system pipe sleeves, or accepted equivalent.
  - 3. Where penetration is part of air duct or plenum system: Do not use plastic pipe for sleeves where floor being penetrated is part of an air plenum so that no fire or smoke hazard is introduced by use of plastic.
  - 4. Where penetration is through fire rated barriers: Provide mild steel sleeves for penetrations of fire rated barriers.
- C. Pipe Sleeves in Walls and Partitions:
  - 1. Sleeves Above Grade: Use schedule 40 mild steel pipe or schedule 80 CPVC pipe. Provide sleeves built into wall, partition or beam of size to allow penetration by carrier pipe and insulation covering with not less than 1/4 inch minimum clear

space between outer surface of carrier pipe covering (or carrier pipe surface if no covering is provided) and inner surface of sleeve.

2. Sleeves Below Grade in Exterior Walls: Schedule 40 steel hot dipped galvanized after fabrication or cast iron sleeve with not less than 1/4-inch x 3-inch center flange (water stop) around the exterior face of the wall.
  3. Penetrations of fire rated barriers shall have only mild steel sleeves; plastic is not allowed.
- D. Pipe Sleeves in Floors Above Grade: Use schedule 40 mild steel pipe or schedule 80 CPVC pipe. Provide sleeves built into wall, partition or beam of size to allow penetration by carrier pipe and insulation covering with not less than 1/4 inch minimum clear space between outer surface of carrier pipe covering (or carrier pipe surface if no covering is provided) and inner surface of sleeve. Set sleeves before floor is poured; extend not less than 1/2-inch above finished floor.
- E. Pipe Sleeves in Floors on Grade: Sleeves shall be Schedule 40 steel or Schedule 80 CPVC plastic. Set sleeves before floor is poured. Size sleeves to allow penetration by carrier pipe and insulation covering with not less than 1/4 inch minimum clear space between outer surface of carrier pipe covering (or carrier pipe surface if no covering is provided) and inner surface of sleeve. Extend sleeve not less than 1/2 inch above finished floor.
- F. Duct Sleeves: Sleeves or openings sized to pass mechanical ducts and covering shall be of framed steel construction in roof, wall, and partitions.
- G. Sealing of Sleeves:
1. Pipe Sleeves Below Grade and On Grade: Caulk annular space between pipe and sleeve using approved caulking material to a minimum one inch deep. Result shall be a water tight and vermin proof penetration.
  2. Pipe and Duct Sleeves Above Grade: Openings around pipes, ducts and other conduit passing through sleeves shall be made draft free and vermin-proof by solidly packing with mineral wool or fiberglass or by other such approved method.
  3. Pipe and Duct Sleeves Through Fire Rated Barriers: All penetrations through fire rated barriers (both walls and floors) shall comply with Division-07 or be as specified in this Division.

## 2.7 FIRE/SMOKE RATED FLOOR, PARTITION OR WALL PENETRATION SEALANT

- A. Seal shall be composed of fire barrier product, putty, or caulking materials used either in combination or singularly. Acceptable Manufacturers are 3M Corporation or Dow Corning.

## 2.8 EXCAVATION AND BACKFILL

- A. Provide as necessary to accomplish work specified. Perform in accordance with applicable State and Local codes and accepted good practice and in accordance with other applicable sections or divisions.

## 2.9 BELT DRIVES

- A. General: Equip each motor driven machine not direct connected with V-belt drive. Belts shall be of correct cross section to fit properly in sheave grooves and shall be carefully matched for each drive. Sheaves shall be cast iron or steel, bored to fit properly on shafts and secured with keys of proper size. The rating of each drive shall be as recommended by manufacturer for service but shall be at least 1.5 times nameplate rating of motor.
- B. Speed Adjustment: Adjust fan speed by change(s) in sheave size as necessary to obtain proper design air flow with fan in its installed location. Fans may be first fitted with variable pitch drives until proper speed adjustment is made and then fitted with proper fixed pitch drive size, or alternate sizes of fixed pitch drives may be used until proper fan needed to deliver necessary air quantity.
- C. Vibration of Air Handling Equipment and Fan Units: For air handling equipment and fans driven by motors 5-hp or greater, field vibration levels will not be acceptable if the maximum vibration velocity or displacement measurement exceeds the following values (when measurements are taken at the bearing supports using a vibration analyzer with the filter set at the operating fan speed):

<u>Fan Speed (RPM)</u>	<u>Maximum Vibration Level</u>
800 or Less	5 Mils (0.127 mm) max. displacement
801 and Greater	0.20 in/sec. (5 mm/s) max. velocity

- D. Belt and Coupling Guards: Each belt drive shall be equipped with an OSHA approved guard. Guards shall be constructed of #12 U.S. standard gage 3/4-inch diamond mesh wire screen, or equivalent, welded to one inch steel angle frames, and shall enclose all belts and sheaves. Tops and bottoms of guards shall be of substantial sheet metal or not less than #18 U.S. standard gage. Braces or supports must not "bridge" sound and vibration isolators. Guards shall be designed with adequate provision for movement of motor required to adjust belt tension. Means shall also be provided to permit oiling, use of speed counters, and other maintenance and testing operations with guard in place. All direct drive equipment shall have coupling guards in accordance with Florida Department of Business Regulation safety regulations and OSHA.

## 2.10 BEARINGS

- A. All bearings shall be 200,000-hour rated unless otherwise specified.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT ACCESS

#### A. Access Doors and Panels:

1. Locations: Provide access unit at the following locations.
  - a. Where additionally specified in other sections of this Divisions 22 and 23 and where specifically indicated on the drawings.
  - b. Where not specifically indicated on the drawings but where the work to be provided will require accessibility for purposes as described or as recommended by the manufacturer of the concealed item.
  - c. At all locations where concealed equipment, fixtures, devices and similar items require accessibility for service, inspection, maintenance, repair, replacement and where such concealed item would not otherwise be accessible for such functions without the provision of an appropriately sized access unit.

#### B. Installation:

1. Definitions: For the purpose of coordination of responsibility, the following words are defined to describe the intended coordination.
  - a. "Furnish" means to procure an item and deliver it to the project for installation.
  - b. "Install" means to determine (in coordination with others as necessary) the intended appropriate location of an item and to set, connect and otherwise fix in place in a manner to allow intended operation and use.
  - c. "Provide" means to both furnish and install fully and completely in all aspects.
2. Furnishing Access Units: Access units shall be furnished as work of the Division which governs the item which is intended to be made accessible by the access unit.
3. Installing Access Units: Access units shall be installed as work of the Division which governs the surface, barrier, partition or other building component in and on which the access unit is to be placed.
4. Determination of Locations:
  - a. Where the work of Divisions 22 or 23 requires that the access unit be provided (i.e., both furnished and installed), then the responsibility for determination of the location at which the access unit is to be placed is also work of Divisions 22 and 23.



- b. Where the work of Divisions 22 or 23 requires that access unit be furnished for installation as work of another Division, then the responsibility for determination of the location at which the access unit is to be installed shall be work of Divisions 22 and 23. Conversely, where the work of one Division requires that an access unit be only installed, then the responsibility for determination of the location of which the access unit is to be installed shall be work of Divisions 22 or 23 which furnishes the access unit.

5. Determination of Sizes:

- a. Unless an access unit size is indicated on the drawings or otherwise specified, the size of each access unit shall be determined as work of the Division which either provides or furnishes the access unit.
- b. Sizes for access units which are provided or furnished as work of this Division shall be in compliance with sizing criteria of this Division.

3.2 PAINTING

- A. Paint all exposed piping, insulation, equipment, structural bases, racks, in equipment rooms and on roof, furnished under Divisions 22 and 23 of these specifications. All exposed metal surfaces shall be given one prime coat and two finish coats. All insulated surfaces shall be given one sizing coat of glue sizing (omit this step if factory applied finish is suitable to receive prime coat), one prime coat and one finish coat. Factory painted or finished items do not require field painting but shall require "touch-up" with matching paint or finish where scratched.
- B. Pipe hangers, saddles, supports, riser clamps and accessories shall be painted to match their piping.
- C. Equipment not completely accessible for painting when set in place shall be thoroughly cleaned and painted before installation and suitably protected.
- D. Piping concealed need not be painted.

3.3 HANGERS AND INSERTS

- A. Refer also to other sections which may describe additional requirements for hanging and supporting. Comply with the more stringent requirement if more than one method is specified or shown.
- B. Provide and properly locate hangers to adequately support piping and equipment. Arrange hangers to permit expansion and contraction.
- C. The size of hanger for non-insulated pipes shall be suitable for pipe size to be supported. For insulated piping, the size of the hanger shall be suitable for the pipe size, plus the insulation and a 16-gauge half-circle galvanized sheet metal insulation saddle.

- D. Isolation of copper pipe from steel hangers to consist of wrapping pipe at, and 1" each side of contact surface with not less than two layers of adhesive type plastic electrical insulating tape.
- E. Pipe supports for piping 2" diameter and below may be supported directly from Epicure steel decking using Epicure standard hangers (200 lb. max. load). Piping above 2" shall be supported from steel beams.
- F. Locate pipe supports as follows unless noted in other sections of these specifications or on the drawings:
  - 1. Horizontal cast iron pipe inside building - supported on each length of pipe.
  - 2. Vertical cast iron pipe inside building - supported at each floor level and at the base.
  - 3. Horizontal steel piping and copper tubing 1" diameter and under - support on 6' centers.
  - 4. Horizontal steel piping and copper tubing above 1" through 1-1/2" diameter - support on 8' centers.
  - 5. Horizontal steel piping and copper tubing larger than 1-1/2" diameter - support on 10' centers, except 24" diameter piping shall be supported by main roof beams (20' O.C. maximum).
  - 6. Support vertical cast iron, steel and copper piping at each floor penetration not to exceed 20 foot intervals.

### 3.4 ANCHORS

- A. Install a suitable anchor on piping to prevent movement from expansion and contraction by welding or clamping securely to pipe at fitting or coupling. Approval of the Architect/Engineer of method of anchorage must be obtained before installation of work. Properly anchor piping to remove strains on equipment which would be caused by expansion and contraction. Adequately insulate anchors on piping, with operating fluid temperatures below 75°F, to prevent moisture condensation problems.

### 3.5 EXPANSION AND CONTRACTION PROVISIONS

- A. Piping is designed with offsets and loops to provide for expansion and contraction. At such points, piping shall be cold sprung to equalize expansion when at operating temperatures. Install piping to maintain grade at all operating temperatures.

### 3.6 FLASHING

- A. Flashing shall be done as work of other divisions.

### 3.7 SLEEVES FOR PIPING

- A. Provide sleeves for all piping where pipe penetrations in walls, floors or other building structure are required. Sleeves in poured concrete shall have water tight seams and joints.
- B. Extend sleeves through walls, partitions and ceilings to finished surface. Extend sleeves through finished floors to not less than 1/4 inch above finished surface. Extend sleeves in concrete floors in chases to not less than 1 inch above floor top surface. Sleeves installed above finished ceilings as part of fire/smoke rated wall assemblies shall extend not less than 1" beyond both wall faces.
- C. Provide sleeves of adequate size to permit clearance for pipe movement and proper grading and sloping of pipes. Provide sleeves for insulated pipe of adequate size to clear insulation.
- D. Caulk space between sleeve's inner surface and pipe's outer surface (including insulation surface if pipe is insulated) with approved with fire rated safig material. Provide flexible fire retardant sealant if pipe is subject to expansion or contraction. Final result shall be an approved fire and smoke stop at pipe and sleeve assembly.
- E. Sleeves in walls and slabs subject to hydrostatic pressures shall be water tight at twice the hydrostatic pressure expected to be encountered at the location of the penetration.

### 3.8 SLEEVES FOR DUCTWORK

- A. Ductwork sleeves shall be provided in accord with current SMACNA recommendations or as otherwise detailed on Drawings. Refer also section describing duct systems.

### 3.9 ESCUTCHEONS

- A. Provide chrome plated brass escutcheons (for 1/4 or 1 inch projecting sleeves as required) at each point where an uninsulated pipe passes thru a finished surface.

### 3.10 CONCRETE BASES AND STRUCTURAL STEEL

- A. Concrete bases and structural steel to support equipment and piping installed under each specification section or division and not specifically shown on the structural or architectural plans shall be furnished for this work.

### 3.11 SEALANT

- A. Fire/smoke sealant shall be installed in strict compliance with the manufacturer's installation instructions.

END OF SECTION

## SECTION 230515 - INSTRUCTIONS AND MAINTENANCE MANUALS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide complete written and verbal operating and maintenance instruction to the Owner for all mechanical systems.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Divisions 22 and 23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections which describe the following:
  - 1. Valves and piping systems components requiring maintenance and which are involved in the dynamic function of the systems.
  - 2. Pumps and related flow devices.
  - 3. Plumbing equipment (heat exchangers, packaged systems, etc.)
  - 4. HVAC equipment (all air handling equipment, terminal units, filter assemblies, etc).
  - 5. Control systems.

### PART 2 - PRODUCTS

#### 2.1 INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Provide three Instructions and Maintenance Manuals, each complete as follows:
  - 1. Hardback three-ring loose-leaf binders.
  - 2. Title sheet with job name, Contractor's, subcontractor's control subcontractor and related contractor's or material supplier's names, addresses and phone numbers.
  - 3. Index of contents.

4. A signed copy of acknowledgment of instructions to the Owner or his authorized representative. Two additional copies of the signed acknowledgment shall be sent directly to the Architect as soon as possible after receipt.
5. Typewritten operating instructions for the Owner's personnel describing the following for each piece of equipment and systems:
  - a. How to start and stop each piece of equipment.
  - b. How to set equipment and systems for normal operation.
  - c. Normal restarting procedures before contacting the service contractor.
  - d. Complete description of functions and operations of each piece of equipment including description of how equipment operates in conjunction with automatic control systems.
  - e. Instructions for cleaning, oiling, greasing, fueling and similar tasks.
6. Approved shop drawings and submittal data and parts and maintenance booklet for each item of material and equipment furnished under this Division, including (but not limited to) the following:
  - a. Spare parts list and source of supply for each equipment item.
  - b. List of valves with location, service, size, model and operating position.
  - c. Diagrams clearly indicating automatic control hook-up.
7. Any as-built wiring diagrams as called for in other sections of this division as needed to show how equipment controls interface with related systems.
8. Copies of certificates of inspection.
9. Guarantees.

## PART 3 - EXECUTION

### 3.1 VERBAL INSTRUCTION

- A. Provide verbal, hands-on, operating and maintenance instruction to Owner's authorized personnel for each equipment item and system. Instruction shall be given by competent personnel.

1. Duration: Total instruction period for all systems of this Divisions 22 and 23 shall be not less than fifteen (15) working days. The Owner reserves the right to audio-tape or video-tape the instruction procedure.

### 3.2 MANUFACTURERS' SERVICE REPRESENTATIVES

- A. Verbal instruction at the site for the following equipment items and systems shall be given jointly by the contractor and the authorized manufacturer's service representative. (Contractor and manufacturer's service representative shall provide instruction to Owner for each equipment item of no less duration than the hours indicated in parenthesis. Duration shall be greater if otherwise specified).
  1. Water Cooled Chillers. (48 hours)
  2. Pumps. (16 hours)
  3. Heat Exchanger. (8 hours)
  4. Air Handling Units. (48 hours)
  5. Exhaust Fans. (24 hours)
  6. Terminal Units. (8 hours)

END OF SECTION

## SECTION 230516 - HOUSEKEEPING PADS, CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide concrete housekeeping pads for the equipment listed in this section. This work shall be performed by the concrete installer.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Divisions 22 and 23 and to all other applicable portions of the drawings and specifications.
- B. This section directly related in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Concrete described in other divisions.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. All concrete and steel for concrete housekeeping pads shall comply with those sections of the specification division describing concrete and steel.

#### 2.2 HOUSEKEEPING PADS

- A. Provide reinforced (#4's @ 12" both ways with 1-1/2" top cover) concrete housekeeping pads for each individual machine. Pads shall extend six inches beyond the machine bases in all directions and be continuous beneath the machine. Pads shall have chamfered edges and shall be poured and finished smooth and level to insure proper and continuous support for the bearing surfaces of the machine.
- B. Coordinate exact length and width of each pad and any penetrations which may be necessary for piping or conduit with the actual equipment approved for use on the project.



## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Refer to the section describing vibration isolation for equipment which is to rest on concrete housekeeping pads.

### 3.2 PAD HEIGHTS

- A. Provide 6" high concrete pads for the following:
  - 1. All equipment specified or shown to be on a concrete pad if no height is given.
  - 2. Indoor air handling units.
  - 3. Control air compressor assembly.
  - 4. Compression tank assembly (if floor mounted).
  - 5. Floor mounted pumps.
  - 6. Heating hot water boilers.
  - 7. Domestic water heaters.

END OF SECTION

## SECTION 230518 - PIPING: CONDENSATE DRAIN

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide condensate drain piping from cooling coil drain pans.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Air handling equipment with cooling coils.
  - 2. Insulation.

#### 1.4 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions".

### PART 2 - PRODUCTS

#### 2.1 PIPE

- A. Type M hard drawn copper conforming to ASTM Spec. B88.

#### 2.2 FITTINGS

- A. Wrought copper, solder joint, pressure type conforming to ANSI B16.22.

#### 2.3 SOLDER

- A. Composition SB5 (95/5), Fed. Spec. QQ-S-571d and Class 3 (Sil Fos), Fed. Spec. AA-S-561d, ASTM B32.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Piping shall be sloped uniformly toward drain, and provided with trap seal having a depth, in inches, equivalent to one and one-half (1-1/2) times the total static pressure of the respective fan system. Traps shall be assembled using elbows and tees with threaded brass plugs to permit cleaning of trap and drain line. Piping shall be installed in a neat manner and shall be not smaller than full size of the equipment drain connection or three-quarters inch (3/4") whichever is larger.

### 3.2 JOINTS AND CONNECTIONS

- A. General: Joints and connections shall be made permanently air, gas, and water tight.
- B. Solder Joints: Cut pipe square using cutting tool which does not crimp pipe. Remove all burrs using pipe reamer and taking care not to flare the pipe end. Thoroughly clean the outside of pipe and the interior of the fittings using a fine sand cloth. Apply noncorrosive paste flux to the cleaned surfaces immediately and apply solder and heat, in accordance with manufacturer's instructions, to complete joint.
- C. Equipment Connections: Connections to copper drain nipples may be made with solder joints provided care is exercised not to damage equipment, its insulation or finish. Connections to equipment having steel nipples shall be made using screwed to solder adapters with teflon tape applied to male threads prior to assembly.

### 3.3 ROUTING

- A. Unless otherwise indicated, route pipe discharge as follows:
  - 1. Roof Mounted Equipment: To nearest roof drain.
  - 2. Interior Equipment: To nearest floor drain.

### 3.4 INSULATION

- A. Insulate if so specified in section describing insulation.

END OF SECTION

## SECTION 230519 - GAUGES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide pressure gauges, gauge valves, test plugs, snubbers and similar devices for indication of operating conditions of such points as are indicated on drawings and as specified herein.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Thermometers.
  - 2. HVAC piping systems.
  - 3. All HVAC equipment through which fluid flows and at which fluid pressures may need to be determined.

#### 1.4 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Provide schedule of ranges and proposed locations.

### PART 2 - PRODUCTS

#### 2.1 GAUGES

- A. Four and one-half inch (4-1/2") diameter with cast aluminum black finish flangeless case and chrome ring. Bourdon tube: phosphor bronze, silver soldered to socket and tip. Socket: forged brass bottom outlet type. Movement: stainless steel rotary type with delrin sector and bushings and micrometer type pointer. Acceptable: H.O. Trerice Co. 500X or an equivalent.
- B. Where Permanent Gauge is Installed: Brass, needle valve, round knurled handle, 1/4" male x 1/4" female NPT. Acceptable: H. O. Trerice Co. 735 Type FFG, or equivalent.

- C. Where Permanent Gauge is Not Installed: Brass gate valve 1/4" female NPT. Acceptable: Crane No. 438 or NIBCO No. T-113, or equivalent.

## 2.2 PRESSURE SNUBBER

- A. Brass, 1/4" male x 1/4" female NPT. Acceptable: H. O. Trerice Co. 872-2, or equivalent.

## 2.3 COILED SYPHON PIGTAILS

- A. Single turn 360 degree coil, arranged with plane of coil parallel to its flow, constructed of 1/4" tubing with male NPT threads on both end extensions. Acceptable: H. O. Trerice Co. 885-series.

## 2.4 TEMPERATURE/PRESSURE TEST PLUGS

- A. Use at Contractor's option as specified in Part 3 of this section. Body of brass or 316 stainless steel. Valve core of neoprene for applications to 200°F and of Nordel for applications to 275°F. Rated for pressure to 1000 psig. Screwed hexagonal cap and gasket. Size 1/4" NPT or 1/2" NPT as applicable. Length 1-1/2" or 3" as applicable to penetrate and allow for insulation. Designed for taking temperature and pressure readings when used with recommended probes. Acceptable: Pete's Plug, Standard or XL Size as manufactured by Peterson Equipment Company, Inc., Richardson TX 75081; Sisco P/T Plugs; or equivalent.

1. Test Kit: Provide Owner with one companion test kit suitable for taking temperature and pressure readings with test plugs. Provide to Architect/Engineer written certification of delivery of test kit to Owner; certification shall be signed by Owner's authorized representative.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Install pressure gauges, gauge valves, test plugs and snubbers in accordance with manufacturer's instructions and locate in such a manner as to permit easy reading of all gauges associated with a single piece of equipment from a single point on the floor (or working platform).

## 3.2 PRESSURE GAUGES

- A. Install in such a manner as to give an accurate reading of the actual conditions and to permit easy access to gauge and gauge valve. Where mounting location does not permit rotation of the gauge for removal, install using the union type (880) gauge valve. Range shall be selected to read near center at normal operating conditions.

### 3.3 GAUGE VALVE

- A. Install using brass nipples of sufficient length to raise gauge valve clear of insulation and finish.

### 3.4 SNUBBER

- A. Provide on all gauges at suction and discharge of all pumps and elsewhere as required to prevent pulsation.

### 3.5 COILED SYPHON PIGTAIL

- A. Provide on pressure gauges used to steam service. Install pigtails and gauges vertically.

### 3.6 LOCATIONS NOT SHOWN ON DRAWINGS

- A. Provide as described in this section unless individual locations are otherwise shown on drawings.

### 3.7 PERMANENT PRESSURE GAUGE LOCATIONS

- A. Provide permanent gauges, with gauge valves, at the following locations:
  - 1. Fluid inlet and outlet of:
    - a. Each water coil in each air handling unit.
    - b. Hydronic system strainers in main piping system (not required at strainers which may be located at individual air handling units or similar equipment unless otherwise indicated).
    - c. Each air separator.
    - d. Each water inlet and outlet at each chiller.
  - 2. Suction and discharge of each pump.
  - 3. Where otherwise indicated.

### 3.8 GAUGE VALVE ONLY LOCATIONS

- A. Provide gauge valves to permit temporary or permanent installation of gauges for pressure indication at the following locations:
  - 1. Inlets and outlets of water coils at:
    - a. Each fan coil unit.
    - b. Each terminal unit hot water coil.
    - c. Where otherwise indicated.

### 3.9 TEMPERATURE/PRESSURE TEST PLUGS

- A. Where a gauge valve and a thermometer well is indicated as a pair (i.e., side by side), Contractor may at his option, provide only a single test plug. Provide only at the following location (at Contractor's option in lieu of the gauge valves specified above and in lieu of thermometer wells specified in "Thermometers" section):
1. Inlets and outlets of each coil at each terminal unit.
  2. Inlet and outlet of each coil in each fan coil unit.

### 3.10 PROTECTION OF EQUIPMENT

- A. Protect equipment from damage from time of its receipt until final acceptance and shall thoroughly clean the pressure gauges, gauge valves and like items of all dirt and construction debris prior to requesting final inspection. Gauges which become damaged during the course of construction shall be repaired to "as new" condition or shall be replaced with new equipment.

END OF SECTION

## SECTION 230520 - PIPING SYSTEMS: FLUSHING AND CLEANING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Completely flush and clean the new piping systems for chilled water prior to making final connections to the existing central system. Provide all plant, materials, equipment and labor required to flush and clean the new piping systems prior to operation.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SHOP DRAWINGS

- A. Include specific data on: all chemicals, feeders, blow down valves and like items; as well as complete piping diagrams. Include complete description of methods.

#### 1.5 PRESSURE AND TEMPERATURE RATINGS

- A. Unless otherwise specified in this section, components specified by this section shall be recommended and rated for same (or greater) maximum working pressure and temperature conditions which are applicable to the fluid system at the location(s) at which the equipment and systems of this section are installed. Refer to specification section(s) describing the related fluid systems(s) for pressure and temperature ratings applicable to the components of this section.

#### 1.6 MANUFACTURER'S QUALIFICATIONS

- A. The water treatment chemical supplier shall be a recognized specialist, active in the field of industrial water treatment for at least ten years.

### PART 2 - PRODUCTS

#### 2.1 SHOT FEEDER

- A. Provide a temporary shot feeder installed across the pumping system suction and discharge sides to allow injection of cleaning chemicals into the system.



- B. Shot feeders shall be Mogul, Mitco, Garrett Callahan, Culligan, Nalco or equivalent.

## 2.2 WATER TREATMENT CHEMICALS

- A. Formulation shall not contain any ingredients which are harmful to system materials.
- B. Chemicals shall be supplied by Mogul, Mitco, Garrett Callahan, Culligan, Nalco or equivalent.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install chemical feeding systems as indicated, in accordance with manufacturer's installation instructions, to comply with requirements and intended purposes.

### 3.2 SHOT FEEDER

- A. Install shot feeder with adequate pressure differential to permit flow through the chemical feeder body. Connect feed piping to inlet and outlet connections with shutoff valves. Pipe drain valve discharge to drain.
- B. Provide all hardware and chemicals for start-up of system and full operation of initial system fill.
- C. Connect water treatment piping system to mechanical systems and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union or flanges on supply and return, drain valve on drain connection.

### 3.3 CLEANING AND FLUSHING

- A. All piping lines and related equipment shall be thoroughly flushed out with precleaning chemicals designed to remove deposition such as pipe dope, oils, loose rust and mill scale and other extraneous materials. Add recommended dosages of precleaner chemical products and circulate throughout the water system. Feed chemicals at the proper feed rates, check that the cleaning solution is actually in each system, flush the system and shall check each system following flushing to insure all cleaning chemicals have been removed from each system. Open all modulating valves, zone valves and all other system restrictions. Drain, fill and flush system until no foreign matter is observed.
- B. Chemical used for cleaning of systems shall comply with the recommendations of the manufacturers of the major components in the system.
- C. A certificate of cleaning shall be provided by the cleaning chemical supplier to the Owner.

### 3.4 PIPING

- A. Installation of piping shall be made in a manner which provides for all drains and temporary connections necessary to clean and flush the new piping systems.

### 3.5 OTHER REQUIREMENTS

- A. Provide all necessary pipe, valves, fittings, unions and other items necessary for proper installation and removal of all components needed to clean and flush the system.
- B. Locate temporary shot type feeder in valved bypass from pump discharge to pump suction. Provide gate valve in bypass on each side of feeder.

END OF SECTION

## SECTION 230521 - THERMOMETERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide thermometers and wells for temperature indication at such points as indicated on drawings and as specified herein.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Gauges.
  - 2. HVAC piping systems.
  - 3. All HVAC equipment which contains heat transfer components where fluid temperatures may need to be determined.

#### 1.4 SHOP DRAWINGS

- A. Refer to section entitled "General Mechanical Provisions". Provide schedule of ranges and proposed locations.

### PART 2 - PRODUCTS

#### 2.1 THERMOMETERS

- A. Adjustable angle, nine inch (9") long scale, mercury type with range selected to read center scale at normal operating conditions; extension necks and bulb style selected to suit application; armored elements on duct thermometers. Acceptable: H.O. Trerice Co BX93403-1/2 and BS99006 or equivalent.

#### 2.2 SEPARABLE SOCKETS

- A. Provide for each thermometer in piping system. Sockets: Brass with extension neck to suit thickness of insulation and finish 3/4" NPT.

## 2.3 THERMOMETER TEST WELLS

- A. Brass with extension neck to suit insulation cap with chain; 1/2" NPT; extension neck where necessary to penetrate insulation.

## 2.4 TEMPERATURE/PRESSURE TEST PLUGS

- A. Use at Contractor's option as specified in Part 3 of this section. Body of brass or 316 stainless steel. Valve core of neoprene for applications to 200°F and of Norel for applications to 275°F. Rated for pressure to 1000 psig. Screwed hexagonal cap and gasket. Size 1/4" NPT or 1/2" NPT as applicable. Length 1-1/2" or 3" as applicable to penetrate and allow for insulation. Designed for taking temperature and pressure readings when used with recommended probes. Acceptable: Pete's Plug, Standard or XL Size as manufactured by Peterson Equipment Company, Inc., Richardson, TX 75081; Sisco P/T plugs; or equivalent.

- 1. Test Kit: Provide Owner with one companion test kit suitable for taking temperature and pressure readings with test plugs. Provide to Architect/Engineer written certification of delivery of test kit to Owner; certification shall be signed by Owner's authorized representative. Duplicate test kit is not required under this section if provided under section describing gauges.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Install test wells, separable sockets, and thermometers in accordance with manufacturer's instructions. Locate in such a manner (adjusting mounting angle as required) as to permit easy reading of all thermometers associated with a single heat transfer device from a single point on the floor (or working platform).

## 3.2 THERMOMETERS IN PIPING SYSTEMS

- A. Install in such a manner as to give accurate reading of actual conditions. Make allowance for proper (unrestricted) flow by installing in oversized fitting in line sizes two inches (2") and under.

## 3.3 THERMOMETERS IN DUCT SYSTEMS

- A. Install in such a manner as to give accurate reading of actual conditions.

## 3.4 PROTECTION OF EQUIPMENT

- A. Protect equipment from damage from time of receipt until final acceptance. Thoroughly clean thermometers, wells and like items of all dirt and construction debris prior to requesting final inspection. Thermometers which become damaged

during course of construction shall be repaired to "as new" condition or shall be replaced with new equipment.

### 3.5 LOCATIONS NOT SHOWN ON DRAWINGS

- A. Provide as described at locations in this section unless individual locations are otherwise specifically shown on drawings.

### 3.6 THERMOMETER LOCATIONS

- A. Provide permanent thermometers and companion wells at the following locations:

1. Fluid inlet and outlet of:
  - a. Each water coil in each air handling unit.
  - b. Each water inlet and outlet of each chiller.
2. Where elsewhere specified or indicated on the drawings.

### 3.7 THERMOMETER TEST WELL LOCATIONS

- A. Provide thermometer test wells at:

1. Inlets and outlets of each water coil at each unit which is not a packaged air handling unit or a built-up air handling unit (i.e., terminal unit hot water coils, fan coil unit coils, duct mounted hot water coils and similar units).
2. Where elsewhere specified or indicated on the drawings.

### 3.8 TEMPERATURE/PRESSURE TEST PLUGS

- A. Where a thermometer well and a gauge cock is indicated together as a pair (i.e. side by side), Contractor may, at his option, provide only a single test plug is required. Provide only at the following locations (at Contractor's option in lieu of the test wells specified above and in lieu of the gauge cocks specified in "Gauges" section).

1. Inlets and outlets of each water coil at each unit which is not a packaged air handling unit or a built-up air handling unit (i.e. terminal unit hot water coils, fan coil unit coils, duct mounted hot water coils and similar units.)
2. Where elsewhere specified or indicated on the drawings.

### 3.9 ADDITIONAL INSTALLATION REQUIREMENTS

- A. Install near pressure gauge cocks and flow meter ports where practical but not to deflect flow and cause raise readings of such other instruments.

- B. Install to cause least possible condensation.
- C. Thermometers shall be easily readable by person in normal position; adjust mounting configuration accordingly.
- D. Provide pipe extensions where installation is in pipe with diameter smaller than insertion length or install in oversized pipe sections.
- E. Install thermometers and test wells as follows so that wells will hold gauge oil without spilling when wells are being used for testing and balancing:
  - 1. In horizontal pipe so that the well is in the top quadrant of the pipe and is not less than 45° from vertical.
  - 2. In vertical pipe so that the well is 45° from vertical.

END OF SECTION

## SECTION 230522 - FLOW STATIONS, VENTURI TYPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide venturi type flow stations, where specified and where indicated on piping plans and schematics, to enable the proper flow balancing of systems.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. HVAC piping systems.
  - 2. Performance verification.
  - 3. Insulation.

#### 1.4 PRESSURE RATING

- A. Be recommended and rated for the pressure conditions occurring at each individual venturi installation location for the particular fluid flow system in which the venturi is installed.

#### 1.5 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Include complete data on: dimensions; working pressure; body pattern; installation instructions including upstream and downstream clearances; indicating and permanent pressure losses; tagging; accessories; and materials and finish.

#### 1.6 MANUFACTURERS

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Gerand

2. Barco
3. Flowset
4. Olympic
5. Preso

## PART 2 - PRODUCTS

### 2.1 FLOW STATIONS

- A. Venturi type, selected to provide an indicating differential pressure, at the design flow rate, between ten (10) and forty (40) inches of water. Permanent pressure loss shall not exceed twenty-five (25) percent of indicated flow rate differential pressure. Stations up to and through two inch (2") in size shall be brass with screw end connections. Stations two and one-half inch (2-1/2") and above shall be steel with butt weld ends.

### 2.2 FLOW STATION ACCESSORIES

- A. Each flow station shall be provided with the following accessories:
  1. Quick Disconnect Valves: Provide quick disconnect valves, compatible with the master meter, for each meter tap of each flow station.
  2. Safety Shut-Off Valves: Provide a safety shut-off valve between each quick disconnect valve and its respective meter tap. Shut-off valves shall be mounted on the flow station with brass pipe nipples of sufficient length to bring the valve clear of specified insulation and finish.
- B. Tag: Provide a metal (or paper bonded between two (2) sheets of plastic) identification tag attached to each flow station with a brass chain of sufficient length to allow tag to clear the specified insulation and finish. Tag shall clearly show: Venturi series and size, station identification, and meter reading at flow required by approved piece of equipment.
- C. Master Meter: Six inch (6") round dial, dry type meter supplied with white on black scale reading from zero (0) to fifty (50) inches of water differential pressure. Meter shall be mounted in a portable fiberglass (rot proof) carrying case complete with two (2) ten foot (10') lengths of one-quarter inch (1/4") high pressure high temperature connecting hose with quick disconnect socket valves, vent valves, vent hoses, operating instructions, and flow station capacity curves.

## PART 3 - EXECUTION

### 3.1 LOCATION

- A. Provide venturi type flow stations where shown on drawings. The flow station locations shown on drawings or otherwise indicated are diagrammatic in nature and



are intended basically to show the requirement for flow measurement relative to a specific piece of equipment or portion of the system and not the exact physical location of the device. The exact physical location shall be determined using field measurements relating to the specific piping arrangement and the manufacturer's requirements relating to upstream and downstream clearances.

### 3.2 PIPING

- A. The actual installation or incorporation of flow stations into the piping system shall be done as work of the Section covering the piping system involved.
- B. Install flow stations in accord with manufacturer's recommendations including increases or decreases in pipe size at point of installation together with minimum recommended lengths of straight run pipe before and after points of installation.

### 3.3 BALANCING

- A. Shall be done, using the master meter specified hereinbefore, as work of the section describing test and balance. At the conclusion of the test and balance work the meter shall be turned over to, and shall become the property of, the Owner. Include a receipt for delivery of the meter, complete as specified herein, in good condition as a part of the Operating and Instruction manuals.

END OF SECTION

## SECTION 230523 - VALVES, COCKS AND SPECIALTIES: HVAC SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide those valves, cocks and specialties which are required for the HVAC piping systems. These items include, but are not necessarily limited to, the following:
  - 1. Gate valves.
  - 2. Check valves.
  - 3. Ball valves.
  - 4. Cocks and plug valves.
  - 5. Drain valves.
  - 6. Butterfly valves.
  - 7. Backflow preventers.
  - 8. Strainers.
  - 9. Safety valves.
  - 10. Pressure relief valves.
  - 11. Air vents.
  - 12. Flow indicating/balancing valves.
  - 13. Pump suction guide/strainer/elbows.
  - 14. Pump discharge/flow control valves.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of the Division-23 and to all other applicable portions of the drawings and specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Piping systems.
  - 2. Pumps.
  - 3. Insulation.
  - 4. Equipment connected to piping systems in which work of this section is applicable.
  - 5. Air control equipment.
  - 6. Work which is described in Divisions 22 and 23 which relate to the plumbing systems and which requires valves, cocks and specialties shall be provided in compliance with this Section unless requirements of Divisions 22 and 23 specifically state otherwise.

#### 1.4 APPLICABLE SYSTEMS

- A. These valves, cocks and specialties are intended for application in, but not necessarily limited to, the following HVAC piping systems as applicable to this project.
1. Chilled water systems.
  2. Hot water systems.
  3. Condenser water systems.
  4. Steam systems.
  5. Other related HVAC piping systems.

#### 1.5 VALVES, COCKS AND SPECIALTIES

- A. Valves, cocks and specialties may not be indicated in every instance on the drawings, but whether or not shown, all valves, cocks and check valves necessary to the proper operation of the system shall be furnished and installed in an approved manner and location. Valves shall have rising stems except in locations where space is limited; in these locations non-rising stem valves of equivalent material and pressure class will be accepted.

#### 1.6 ACCEPTABLE MANUFACTURERS

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
1. Mueller
  2. Hammond
  3. Crane
  4. Powell
  5. Walworth
  6. Lunkenheimer
  7. Stockham
  8. Williams-Hager
  9. APCO
  10. Metraflex
  11. ACFR
  12. Keystone
  13. Centerline
  14. Demco
  15. Gerand
  16. Griswold
  17. Aeroquip

18. Dezurick
19. Watts,
20. Maxwell & Moore
21. Bell & Gossett
22. Beaton-Cadwell
23. McDonnell Miller
24. Maid-O-Mist
25. Sarco
26. Armstrong
27. Nibco
28. Jamesbury
29. Taco
30. Wheatley Pump & Valve
31. Conbraco
32. Grinnell
33. McDonald

- B. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of the item(s) required.

#### 1.7 INDUSTRY STANDARDS

- A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

#### 1.8 PRESSURE AND TEMPERATURE RATINGS

- A. Temperature: Unless otherwise specified, ratings shall be as follows for all components specified herein.

1. Chilled water systems: 150°F
2. Hot water systems: 200°F
3. Condenser water systems: 150°F
4. Steam systems:
  - a. Low pressure (LPS): 275°F
  - b. Medium pressure (MPS): 300°F
  - c. High pressure (HPS): 350°F

- B. Pressure: Unless otherwise specified, all components must be of pressure class and rating to be recommended for operation at the following maximum allowable non-shock pressure ratings.

1. Chilled water systems: 150 psig
2. Hot water systems: 150 psig
3. Condenser water systems: 150 psig
4. Steam systems:
  - a. Low pressure (LPS): 150 psig

- b. Medium pressure (MPS): 150 psig
- c. High pressure (HPS): 200 psig

## PART 2 - PRODUCTS

### 2.1 GATE VALVES

- A. 3" and smaller: Threaded or solder pattern as applicable, rising stem, iron wheel, rough brass body, solid wedge disc, screwed or union bonnet and finished gland nut, 150 psi class. Types as follows:
  - 1. Threaded Pattern: Crane 431, Powell 514S, Walworth 56, Lunkenheimer 2151, Stockham B-122.
  - 2. Soldered Pattern: Powell 1842S, Lunkenheimer 2151, Stockham B-124.
- B. 3-1/2" and Larger: Flanged, cast iron body, brass trim, brass seats, rising stem and iron wheel, 125 psi class. Types as follows: Crane 465-1/2, Powell 1793, Walworth 726F, Lunkenheimer 1430, Stockham G-623.

### 2.2 GLOBE VALVES

- A. 2-1/2" and Larger: Flanged, iron body, yoke bonnet, bronze trim and disc.
- B. 2" and Smaller: Screwed, bronze body, union bonnet composition disc.

### 2.3 CHECK VALVES

- A. Swing type:
  - 1. 3-inches and Smaller: Threaded or solder pattern as applicable, pressure rating of not less than 200 psi threaded pattern and 125 psi solder pattern, wye pattern swing check, rough brass body, finished gland nut, regrinding bronze disc.
  - 2. 4-inches and Larger (125 psi maximum working pressure): Flanged pattern, iron body, swing check, renewable brass seat, disc and trim. Types: Crane 373, Powell 559, Walworth M-928F, Lunkenheimer 1790, Stockham G-931.
  - 3. 4-inch and Larger (200 psi maximum working pressure): Flanged brass-ferrosteel body, swing check, renewable brass seat, disc and trim. Types: Crane 39E, Powell 576, Walworth M-970F, Lunkenheimer 323.

B. Wafer Type:

1. 3-inch and Larger: Flanged pattern, globe type, semi-steel body, stainless steel spring, bronze disc and bronze seat ring. Types: Williams-Hager Figure 636; APCO Series 600; Mueller Nos. 105, 107, 109 and 113; Metraflex Series 900.

2.4 PLUG VALVES AND BALANCING COCKS

- A. General: Semi-steel, lubricated type, bolted cover or gland, position indication dial, full port, teflon coated plug. Over 6-inches shall have a geared or worm drive operator.
- B. 2 inches and Smaller: Screw pattern Powell F-2200, Walworth 1700, ACF R1430.
- C. 2-1/2 inches and Larger: Flanged end. Powell F2201, Walworth 1700F, ACF R 1431.

2.5 DRAIN VALVES

- A. General: Use only for low pressure drainage service.
- B. 2 inches and Smaller: Either threaded or soldered ends, class 125, bronze body, screwed bonnet, rising stem, disc with 3/4" hose thread outlet connect.
  1. Threaded Pattern: Crane 410, Stockham B-100.
  2. Soldered Pattern: Crane 1320, Stockham B108.

2.6 BUTTERFLY VALVES

- A. Pattern: Valves shall be of the threaded lug body type. All valves shall have extended necks for insulation clearance.
- B. Body: Semi-steel or cast iron or pattern specified hereinbefore.
- C. Disc: Bronze or semi-steel with welded nickel edge, 416 stainless steel shaft, bronze bearings, and Hycar seals.
- D. Seat: Hycar, bonded to a rigid reinforcing ring which is held in place by a metal retaining ring. All valves shall be capable of bubble tight shut-off at pressure differentials of 200 psig, and 200 psig dead end shut-off.
- E. Operators: Valves 2" through 6" shall have lever type actuator capable of infinite position (or minimum of 10 locking positions) and shall have adjustable memory stop. Valves 8" and larger shall have gear type actuator with chain wheel, hand wheel or crank type operating mechanisms, adjustable opening and closing memory stops, and position indicator. All valves 4" and larger located more than 6'-0" above the floor shall be provided with chain wheel and chain. Provide stem extensions (in addition to insulation clearance extension specified hereinbefore) as required to

place operators in an easily accessible location free of interference with adjacent piping, equipment structure, and the like.

F. Manufacturers: Grinnell, Keystone, Center-Line, Demco, DeZurick.

## 2.7 BALL VALVES

A. 2-1/2 inches and Smaller: Threaded or soldered ends, port area equal to or greater than connecting pipe diameter, Class 125, two piece bronze body, bronze ball, bronze stem, teflon seat and seals. Acceptable manufacturers; Crane, Hammond, Jamesbury, Nibco, Stockham, and Walworth.

## 2.8 CALIBRATED BALANCING AND FLOW MEASURING VALVES

A. 1/2" to 2": Globe type providing flow balancing, flow measurement, positive shut off, and drain connection. Balancing valves shall be provided with vernier-type setting with adjustment range through four 360 degree turns of handwheel. Valves shall have hidden memory feature to prevent tampering. Valves shall be provided with meter connections having positive shut off valves. All metal parts shall be of nonferrous, pressure die-cast, nonporous Ametal Copper Alloy. Valve shall provide accurate flow control regardless of valve orientation. Provide form-fitting polyurethane insulation cover. Design basis Armstrong CBV I. Acceptable Alternates: Accepted equivalents by Bell & Gossett, Taco, and Preso.

B. 2-1/2" to 6": Globe type providing flow balancing, flow measurement, and positive shut off. Balancing valves shall be provided with vernier-type setting with adjustment range through eight 360 degree turns of handwheel. Valves shall have hidden memory feature to prevent tampering. Valves shall be provided with meter connections having positive shut off valves. Valves shall be cast iron with brass trim. Design basis Armstrong CBV II. Acceptable Alternates: Accepted equivalents by Bell & Gossett, Taco and Preso.

C. Provide Owner: One portable differential pressure gauge kit of same manufacturer as valves. Kit shall be housed in a hand-carrying case and shall contain one 0-135" W.C. and one 0-60 foot pressure gauge, 5 foot meter hoses with disconnect ends, positive shutoff valves, operating instructions, and flow versus pressure drop curves for each size valve installed.

## 2.9 STRAINERS

A. General: Y-type.

B. Body: Cast iron, ductile iron, cast or forged steel as required for specified working pressure of piping system.

C. Screen: 315 stainless steel or monel. Free area not less than three times inlet area.

1. Perforations: 1/8" mesh for sizes to 8-inches. 5/32" mesh for sizes 10-inches and larger.

D. Connections:

1. Straight thread and gasket to 2-inch size.
2. Flanged 2-1/2 inches and larger.
3. Solder pattern when used in copper piping systems.

E. Bolted cover in 2-1/2 inch and larger.

F. Gate Valve: On 2-1/2 inch size and larger, provide a gate valve on each strainer cover blowdown connection; gate valve to be full size of blowdown connections.

2.10 SAFETY VALVES

A. General: ASME rated as shown on the drawings and/or required by applicable codes.

B. Manufacturers: Manning, Maxwell & Moore, Watts Regulator, or Bell & Gossett Co.

2.11 PRESSURE RELIEF VALVES

A. One-half (1/2) or three quarter (3/4) inch size, brass, iron or steel, ASME rated.

2.12 AIR VENTS

A. Automatic:

1. 150 psi Working Pressure: Metraflex MV-15, Crane 976, Sarco 13W, Armstrong 1AV.
2. 75 psi Working Pressure: Maid-O-Mist #7, Bell & Gossett #7, Hoffman 79.

B. Manual: Brass manual cock, Crane 700 Series, with hose thread adapter.

2.13 PUMP SUCTION GUIDE/STRAINER ELBOW

A. Sizes Allowable: 2" through 12".

B. Construction: At the Contractor's option, in lieu of strainer and long sweep elbow, provide at each pump a suction guide/strainer elbow. Units shall consist of cast iron angle type body (175 psi pressure rated) with cast iron inlet vanes and a combination stainless steel diffuser strainer with 3/16" or 1/3" diameter openings for pump protection. (Unit shall be equipped with a disposable brass or bronze fine mesh start up strainer which shall be removable after 30 days). The body outlet pipe size shall be equal to the pump suction pipe size. The unit shall be provided with an adjustable support foot to relieve piping strains from the pump suction, threaded pressure gage tap at the body inlet and blowdown tapping in bottom.



- C. Acceptable Manufacturers: Armstrong Pumps, Inc., Taco, Inc.; Bell & Gossett or equivalent.

## 2.14 PUMP DISCHARGE/FLOW CONTROL VALVES

- A. Allowable Sizes: 1-1/2" through 10".
- B. Construction: At Contractor's option, install pump discharge valves on each pump discharge line in lieu of separate shutoff valve, check valve, and balance cock. Pump discharge flow control shall be cast-iron valve body, pressure rated for 175 psi, maximum operating temperature of 300°F. Provide check valve and calibrated adjustment feature permitting regulation of pump discharge flow and shutoff. Bronze gland, stainless steel stem, brass or bronze seat, graphited asbestos packing or double "O" ring seal straight or angle pattern. Angle pattern valves shall be provided with adjustable support foot.
- C. Acceptable Manufacturers: Armstrong Pumps, Inc., Bell & Gossett; Taco, Inc.; or equivalent.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install valves in horizontal piping with the valve stem in the vertical upright position.
- B. Install valves to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.
- C. Provide blow down valve on 1-1/2" and larger strainers (except refrigerant piping). Use valve not less than 1/2 strainer blow down outlet size.

### 3.2 VALVES AND COCKS

- A. All valves, balancing cocks and similar items shall be installed in an easily accessible location. Provide access panels for all concealed valves. Where gate valves are indicated on the drawings, the Contractor may, at his option, furnish butterfly valves, provided they are in compliance with these specifications. Where butterfly valves are used, they shall be installed between properly spaced flanges, then run to the full open position before mounting bolts are tightened in order to insure a balanced pressure on the seat and prevent distortion.

### 3.3 PRESSURE RELIEF VALVES

- A. Install pressure relief valves where specified or indicated on the drawings. Pipe to spill over floor drain or service sink. Provide pressure expansion device for all valves set for 150-psig or greater.

### 3.4 PUMP DISCHARGE FLOW CONTROL VALVES

- A. Where such valves are used, install pump discharge/flow control valves on each pump discharge. Install in horizontal or vertical position with stem in upward position; allow clearance above stem for check valve mechanism removal. After hydronic system has been completed, mark calibrated name plate with stripe of yellow lacquer to permanently mark final balanced position.
- B. Install adjustable foot support for angle pattern valves to carry weight of discharge piping.

### 3.5 SAFETY VALVES

- A. Safety valves to have valve spindle enclosure with gland seal to minimize leakage and manual lift lever to check discharge required. Cut discharge pipe from safety valve on a 45 degree angle, pipe to floor and direct toward or into floor drain (unless noted otherwise on the drawings).

### 3.6 AUTOMATIC AIR VENTS

- A. Install automatic air vents with inlet isolation cock at locations indicated on drawings and at high points of hot and chilled water piping systems. Pipe vent discharge to drain pan, plumbing trap or to outside of building.

### 3.7 DRAIN VALVES

- A. Install drain valves at the base of all water piping risers (both supply and return) and at all low points in the piping system.

### 3.8 BALL VALVES

- A. Ball valves may be installed in lieu of gate valves for all individual fan coil unit supply and return piping 1" and smaller.

### 3.9 VALVED GAUGE CONNECTIONS

- A. Contractor shall provide valved gauge connections at diffuser inlet and pump suction to indicate when cleaning is needed. Install on pump suction inlets, adjust foot support to carry weight of suction piping. Install nipple and shutoff valve in blowdown connection. After cleaning and flushing hydronic piping system, but prior to balancing of hydronic piping system, remove disposable fine mesh strainer.

### 3.10 CALIBRATED BALANCING AND FLOW MEASURING VALVES

- A. Provide flow indicating balancing valves where shown on drawings. The locations shown on drawings or otherwise indicated are diagrammatic in nature and are intended basically to show the requirement for flow measurement and shut-off relative to a specific piece of equipment or portion of the system and not the exact physical location of the device. The exact physical location shall be determined using field measurements relating to the specific piping arrangement and the

manufacturer's recommendations relating to upstream and downstream clearances. Install in accordance with manufacturer's recommendations including increases or decreases in pipe size at points of installation together with minimum recommended lengths of straight run pipe before and after points of installation. Balancing shall be done, using the master meter specified hereinbefore, as work of the section describing test and balance. At the conclusion of the test and balance work the meter shall be turned over to, and shall become the property of, the Owner.

### 3.11 MECHANICAL ACTUATORS

- A. Install mechanical actuators with chain operators where indicated, and where valves 4" and larger are mounted more than 7'-0" above floor in mechanical rooms, chiller rooms, boiler rooms; and where recommended by valve manufacturer because of valve size, pressure differential or other operating condition making manual operation difficult.

END OF SECTION

## SECTION 230524 - AIR CONTROL EQUIPMENT, HYDRONIC SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide a complete system of makeup water and/or air control equipment for each separate chilled water and/or hot water system as indicated on drawings and as specified herein.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. HVAC water piping systems.
  - 2. Valves, cocks and specialties for HVAC systems.

#### 1.4 TERMINOLOGY

- A. Compression tanks and expansion tanks shall be considered the same regardless of terminology.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Equipment shall be sized as indicated on drawings.

#### 2.2 EXPANSION TANK(S)

- A. Tank: Steel, ASME approved, 125 psig working pressure.
- B. Trim: Gauge glass, gauge cocks and all necessary tappings including union connected gauge valves, stainless steel trim, acrylic gauge tube, drain cock, built-in check valves. Acceptable: Penberthy Series 205; Eugene Ernst Products Model EEP 203 or equivalent.

C. Tank Fitting: Designed to control air flow into tank while preventing free interchange of water between tank and system; manual air vent tube; 125 psig; Bell & Gossett ATF or ATFL Series or equivalent.

D. Manufacturer: Taco, Armstrong, Bell & Gossett, John Wood Company or equivalent.

## 2.3 AIR SEPARATION DEVICE(S) GENERAL

A. General:

1. ASME approved and stamped.
2. 125-psig working pressure.
3. Cast iron or steel.

B. Recommended by manufacturer to be suitable for operation with flow rate indicated with pressure drops not in excess of that indicated.

C. Tangential type which operates on low velocity vortex principle of separation of free air from system.

D. Strainer, built-in accessible type.

E. Dimensions suitable for available space.

F. Separators with inlet and outlet connections four inches (4") and larger shall be provided with threaded couplings factory welded to shell for pipe support lets.

G. Design Basis: Bell & Gossett "Rolairtrol", Armstrong, Taco or equivalent.

## 2.4 AIR VENTS

A. Automatic Air Vents: Male pipe thread connection (3/4 inch minimum); brass body; brass or stainless steel float; check valve feature to prevent air re-entry; drain connection; 300°F operating temperature.

1. 150-psig operating pressure: Suitable for 450-psig hydrostatic pressure. Hoffman No.78, Metraflex MV-15, Crane #976, Sarco 13W or Armstrong 1AV or equivalent.
2. 75-psig working pressure: Suitable for 200-psig hydrostatic pressure. Hoffman No.79, Maid-O-Mist #7, Bell & Gossett #7 or equivalent.

B. Manual Air Vents: Brass, suitable for 500 psig operating pressure and 300°F operating temperature, needle valve type, 1/8 inch size minimum, Trerice No. 735, Crane 700 Series or equivalent.

C. Drain Tubing: Type M copper.

## 2.5 MAKEUP WATER ASSEMBLY(S)

- A. Provide for each closed loop chilled water and hot water system. Use the following components or their equivalent:
- B. Reducing Valve(s): Brass body, 3/4-inch or greater F.I.P.T. connections, brass trim, built-in strainer, anti-siphon check valve, extra large diaphragm, adjustable twenty-five (25) to sixty (60) psig. Acceptable: Bell & Gossett #7 or an accepted equivalent.
- C. Relief Valve: Brass body, 3/4-inch or greater M. x F.I.P.T. connections, brass trim, diaphragm operated, seventy-five (75) psig setting.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install all air separators, compression tanks and similar items in strict accordance with the manufacturer's instructions.
- B. Test piping systems prior to the application of any insulation and prior to their being rendered inaccessible by the progress of the work. Pressure test the makeup water piping as specified for the potable water piping system.
- C. Pipe, valves and fittings shall be kept clean and protected from entrance of dirt, non-potable water and construction debris during the installation process.
- D. Refer to sections covering closed loop hydronic systems. Coordinate work of other trades as regards their interface on makeup water piping.
- E. Connect water make-up line to pipe which connects air separation device to compression tank assembly. Pipe size from make-up water connection to air separation device shall be same size as make-up water line.

### 3.2 EXPANSION TANK ASSEMBLY(S)

- A. Drain: Provide valved 3/4 inch minimum diameter tank drain to a point six inches or less above nearest mechanical room floor drain.
- B. Support: Securely support from roof or floor structure and/or from masonry wall(s). Submit shop drawings showing method of support if such drawings are required by Architect/Engineer.
- C. Insulation: Insulate if and as specified elsewhere.

### 3.3 AIR SEPARATION DEVICE

- A. Remove and clean strainer after 24 hours and 30 days of system operation.
- B. Isolate air separator with gate valves.

- C. Install so strainer is accessible.
- D. Provide valved blowdown drain.
- E. Insulate; insulation finish shall match finish of connecting piping insulation.

### 3.4 AIR VENTS

- A. Use automatic vents in concealed spaces. Provide tubing discharge to drain pan, plumbing trap, exterior of building or other approved location. Discharge at inconspicuous and safe location. Install automatic air vents with inlet isolation cock.
- B. Provide manual vents at each heating and cooling water coil in accordance with coil manufacturer's recommendations.
- C. Provide automatic vents as follows:
  - 1. High points of all main hot water and chilled water piping.
  - 2. In all hot water and chilled water pipe sections which form an inverted trap.
  - 3. Where necessary to completely and properly vent all air which may accumulate in piping circuits.
  - 4. Where otherwise indicated.
- D. Provide automatic air vents with gate valve or ball valve in pipe nipple to air vent so that air vent can be removed without affecting pipe system operation.

### 3.5 MAKEUP WATER ASSEMBLY(S)

- A. Provide as follows if not indicated in Divisions 22 and 23 which describe plumbing interface or if not shown on drawings:
  - 1. 1-1/4-Inch (Less if Indicated) Make-up Assembly:
    - a. Automatic feed line with the following in series in direction of flow: Gate valve, pressure regulating valve with built-in check valve feature, check valve, vacuum breaker, pressure relief valve and gate valve.
  - 2. 1-1/2-Inch (Greater if Indicated) Make-up Assembly:
    - a. Automatic feed line in parallel with manual feed line.
    - b. Automatic feed line with the following in direction of flow:

- (a) Pressure regulating valve with built-in check valve, vacuum breaker and pressure relief valve.
- c. Manual feed line with gate valve and check valve.
- d. Gate valve common to both manual and automatic lines on each side of the parallel system.
- e. Connect chilled water and hot water make-up line to pipe which connects air separation device to compression tank assembly. Pipe size from make-up water connection to air separation device shall be same size as make-up water line.

END OF SECTION



## SECTION 230529 - HANGERS AND SUPPORTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this Section.

#### 1.2 SCOPE

- A. Provide all angles, brackets, clamps, anchors, inserts, rods, braces, frames, hangers nuts and bolts, and other miscellaneous steel and hardware items as may be required for the proper support of equipment, piping systems, HVAC systems, plumbing systems and fire protection systems.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Divisions 22 and 23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Piping systems.
  - 2. Duct systems.
  - 3. Equipment items.

#### 1.4 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Provide specific data on hangers, stands, clamps, rollers, guides, shields, anchors and their proposed application. Submit detailed shop drawings, showing method of support and anchoring for all piping and equipment as follows:
  - 1. Piping Systems:
  - 2. Scaled single line piping plans superimposed on structural construction drawings. Scale shall be minimum 1/4" = 1'-0". Piping which is three inch (3") diameter and smaller may be omitted from these shop drawings. Drawings shall clearly indicate the location and type of each and every insert, hanger, stand, support, guide, isolator and anchor; and shall also indicate the size, type locations and method of attachment for all miscellaneous structural steel required.
  - 3. Sectional drawings, sketches and other details as may be required to clearly communicate the method of support, anchoring, guiding and vibration isolation.

4. Show details of any typical floor or wall penetrations including: riser clamp, pipe sleeve, and provisions for water stop to prevent the water travel between penetrations.
- 1.5 INDUSTRY STANDARDS
  - A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.
- 1.6 MANUFACTURER
  - A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
    1. F&S Manufacturing Corp.
    2. Fee and Mason Manufacturing Co.

## PART 2 - PRODUCTS

### 2.1 HANGERS

- A. Hangers In Contact With Copper Piping: Shall be copper plated or teflon coated. Hangers shall be Fed. Spec. WW-H-171E, Type 9. Acceptable: Grinnell Fig. 97 or 97C, or equivalent.
- B. Hangers (other than in Contact with Copper Piping): Shall have manufacturer's standard finish. Hangers shall be of the following types:
  1. Pipe 3" and Larger: Fed. Spec. WW-H-171E, Type 1. Acceptable: Grinnell Fig. 260 or equivalent.
  2. Pipe 2-1/2" and Smaller: Fed. Spec. WW-172E, Type 6. Acceptable: Grinnell Fig. 104 or equivalent.

### 2.2 ISOLATORS

- A. Refer to the Section, if included in this Division, which describes vibration isolation.

### 2.3 PIPE ROLLER STANDS

- A. Shall be Fed. Spec. WW-H-171D, Type 47. Acceptable: Grinnell Fig. 171, or equivalent.

### 2.4 PIPE ROLLER HANGERS

- A. Pipe Roller Hangers: Shall be Fed. Spec. WW-H-171E, Type 42. Acceptable: Grinnell Fig. 171, or equivalent.

## 2.5 PIPE ALIGNMENT GUIDES

- A. Acceptable: Grinnell Fig. 256, or equivalent.

## 2.6 PIPE RISER CLAMPS

- A. Pipe Riser Clamps: Shall be Fed. Spec. WW-H-171D, Type 8.

## 2.7 INSULATION SHIELDS

- A. Shall be Fed. Spec. WW-H-171D, Type 41. Acceptable: Grinnell Fig. 167, or equivalent.

## 2.8 BEAM CLAMPS

- A. Fed. Spec. WW-H-171D, Type 29. Acceptable: Grinnell Fig. 292 with links, or equivalent.

## 2.9 INSERTS

- A. Preset Type: Malleable iron with removable interchangeable nuts having lateral adjustment of not less than one and five-eighths inches. Continuous inserts shall have a capacity of 2,000 lb. per foot and shall be hooked over reinforcing. Acceptable: C-B Universal Fig. 282; Unistrut Products Co., P3200 or P3300; B-Line Systems, Inc., Series B- 32.1, or equivalent.

## 2.10 ROD

- A. Carbon steel, black threaded bolt ends or continuous thread, sized with safety factor of five (5). Acceptable: Grinnell Fig. 140 or 146, or equivalent.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. Refer to Section entitled "General Mechanical Provisions". All inserts, fasteners, hangers and supports shall be installed in strict accordance with manufacturer's instructions.

## 3.2 PIPE

- A. General: Hangers shall be spaced to prevent sag and to permit proper drainage. All piping shall be run parallel with the lines of building, unless otherwise indicated on drawings. The hanger spacing and placement shall be such that after the covering (insulation and finish) is applied, there will be not less than 1/2" clear space between finished covering and other surfaces, including the finished covering of parallel

adjacent pipes. Hangers for insulated pipes shall be sized to encompass the insulation, finish and metal insulation shield (a metal insulation shield shall be provided for each hanger or support). Vertical piping shall be supported with pipe riser clamps at every floor penetration, unless specifically indicated otherwise on the drawings. Hangers and supports shall not be placed at greater than the following intervals:

1. Pipe 1" and Smaller: Eight foot (8') centers and not more than two feet (2') from a change in direction (offsets, elbows, and tees).
2. Pipe 1-1/4" through 2-1/2": Ten foot (10') centers and not more than two feet (2') from a change in direction (offsets, elbows and tees).
3. Pipe 3" and Larger: Fourteen foot (14') centers and not more than two feet (2') from a change in direction (offsets, elbows, and tees).

### 3.3 EQUIPMENT

- A. Equipment supports shall be as otherwise indicated on the drawings or in the specifications.

### 3.4 DUCTWORK

- A. Refer to Sections describing ductwork.

### 3.5 POWDER (GUNPOWDER) ACTUATED FASTENERS

- A. Not allowed.

### 3.6 STEEL DECKING

- A. On projects where floor or roof slabs are installed over steel decking, drill or punch web of steel decking and insert hangers with washers before the concrete fill is poured in place. Hangers shall be plumb within one-half inch (1/2") in four feet (4') and spaced as required for service intended.

END OF SECTION

## SECTION 230535 - ELECTRIC MOTORS, HIGH EFFICIENCY TYPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. This Section describes electric motors which are more efficient and have a generally better power factor than standard horizontal drip proof electric motors. These motors require less energy than standard electric motors which do not meet this specification.
- B. This specification covers horizontal, 3 phase, integral horsepower, drip proof, squirrel cage induction motors in the NEMA frame sizes through 449.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 STANDARDS

- A. All motors shall be in accordance with NEMA Standard MG1-1978, or the latest revision insofar as it is applicable. Motors shall also comply with the applicable portions of the National Electric Code.

### PART 2 - PRODUCTS

#### 2.1 VOLTAGE FREQUENCY

- A. Motors through 100 hp shall be rated 230/460 volts with 200 or 575 volts as optional; motors above 100 hp shall be rated 460 volts with 575 volts as optional. Motors will be rated for operation on a 3 phase, 60 Hertz power supply. Refer to Electrical Drawings.

#### 2.2 COORDINATION

- A. Where variable frequency drives are used to vary the speed and power consumption of electric motors, such motors must be high efficiency type and must be considered with the actual variable frequency drives which are provided so that optimum matching of variable frequency drive to driven motor is obtained.

## 2.3 OPERATING CHARACTERISTICS

- A. Torques: Motors shall meet or exceed the locked rotor (starting) and minimum breakdown torques specified in NEMA standards for Design B for the ratings specified.
- B. Currents: Locked rotor (starting) currents shall not exceed NEMA Design B maximum values for the specified rating. Motors shall be capable of a 20 second stall at six times full load current without injurious heating to the motor components.
- C. Efficiency: Motors shall have a minimum and nominal full load efficiency which will meet or exceed the accepted values for industry standards for high efficiency motors when tested in accordance with NEMA test standard MG1-12.53a, IEEE Test Procedure 112, Method B, using accuracy improvement by segregated loss determination including stray load loss measurements. The minimum efficiency shall be guaranteed.
- D. Power Factor: The power factor for 3600 and 1800 rpm, 3 through 250 hp ratings at full load, at full voltage, shall be a minimum of 85%. Six-pole ratings will be excluded from this requirement.

## 2.4 SERVICE FACTOR AND AMBIENT

- A. Motors shall be rated for a 1.15 service factor in a 40°C ambient.

## 2.5 INSULATION

- A. Motors shall have a full Class B insulation system.
- B. Motors shall be dipped and baked in polyester varnish to consolidate the winding.

## 2.6 FRAME SIZE

- A. Horsepower/frame relationship shall conform to the latest NEMA Standard for T frame motors.

## 2.7 ENCLOSURE

- A. Motors shall be drip proof construction.
- B. Motor frame and endshields shall be of cast aluminum construction using alloys with low copper content.

## 2.8 BEARINGS

- A. All motors shall have anti-friction bearings, sized for a L-10 life of at least 125,000 hours L-10 life for a direct connected load.
- B. Aluminum endshields shall have a cast-in steel or cast iron bearing insert.

- C. Bearing housing shall be regreasable with provisions for purging old grease.
- D. Bearings shall be preloaded with a bearing loading spring to minimize noise and increase bearing life.

## 2.9 OTHER REQUIREMENTS

- A. Conduit Box shall be diagonally split and rotatable in 90 degree increments.
- B. External hardware shall be plated to resist corrosion.
- C. External paint shall withstand industrial environments.
- D. Nameplates shall be of stainless steel or aluminum and stamped per NEMA Standard MG1-10.37. Nameplate information shall include the nominal efficiency value per Standard MG1-12.53b and the manufacturer's minimum guaranteed efficiency value.

## 2.10 SHOP DRAWINGS

- A. In addition to shop drawing requirements of the section entitled, "General Mechanical Provisions", provide motor data including horsepower; rpm; frame size; nominal efficiency and nominal power factor at full load, 75% load and 50% load; guaranteed efficiency and guaranteed power factor at full load, 75% load and 50% load.

## PART 3 - EXECUTION

### 3.1 MOTOR LOCATIONS

- A. Provide high efficiency motors for the following as provided on this project:
  - 1. Motors for new pumps.

END OF SECTION

## SECTION 230548 - VIBRATION ISOLATION EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide vibration isolation supports for all equipment and piping as may be required to prevent transmission of vibration to building structure. This shall include air handling units, fans, piping, pumps and similar items.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the drawings and specifications.

#### 1.4 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Submittal data shall show type, point loading information, size and deflection of each isolator proposed and any other information as may be required for the Architect/Engineer to check isolator selections for compliance with specifications. Include clearly outlined procedures for installing and adjusting the isolators.

#### 1.5 MANUFACTURERS

- A. Products of the following manufacturers will be acceptable, provided they comply with all of the requirements of this specification: Consolidated Kinetics; Mason Industries; Amber-Booth; Keflex; Flexonics; Vibration Eliminator Company or equivalent. Any model numbers listed are from one or more of these manufacturers and are given to provide an example of item(s) required.

#### 1.6 OTHER REQUIREMENTS

- A. All vibration isolation equipment shall be both recommended by the manufacturer and approved by the Architect/Engineer for each particular application on this project.

### PART 2 - PRODUCTS

#### 2.1 BASIC REQUIREMENTS



- A. Unless otherwise noted, spring type vibration isolators shall be used for all motor driven equipment. It shall be the responsibility of isolation manufacturer to determine the amount of spring deflection required for each isolator to achieve optimum performance, prevent the transmission of objectionable vibration and meet noise criteria referenced herein.

## 2.2 CORROSION PROTECTION

- A. Steel components shall be phosphated and painted. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welded slag and primed with zinc-chromate or metal etching primer.
- B. All isolators exposed to weather shall have steel parts PVC coated or hot-dip galvanized. Aluminum components shall be etched and painted. Nuts, bolts and washers may be zinc-electroplated.

## 2.3 BASIC ISOLATORS

- A. General: Unit designations indicated are Architect/Engineer designations. Each of the following basic isolators may not be applicable to a specific installation application. See PART 3, "EXECUTION".
- B. Spring Mounts, Open Type, Unrestrained (Unit SMOU): Free standing springs; laterally stable; minimum horizontal-to-vertical spring rate ( $K_x/K_y$ ) of 1.0: 1/2-inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the equipment (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; 1-inch minimum static deflection (unless otherwise specified); submittals shall include spring diameters, deflections, free spring heights, solid spring heights and operating heights. Be similar to Mason Type SLF; Korfund Series L; Amber-Booth Type SW.
- C. Spring Mounts, Open Type, Restrained (Unit SMOR): Free standing springs; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the equipment (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; 1-inch minimum static deflection (unless otherwise specified); restraint consisting of welded steel channel ends for outdoor installation and welded steel studs for indoor installation; restraint shall have restraining bolts connecting top plate and lower housing to limit vertical rise of isolated equipment when load is reduced; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and housing (leveling bolts shall be adjusted to maintain this clearance). Submittal shall include spring diameters, deflections, free spring heights, solid spring heights and operating heights. Be similar to Mason Type SLR; Amber-Booth Type CT.

- D. Spring Mounts, Housed, Unrestrained (Unit SMHU): Springs free standing within their housing; laterally stable; 1/2 inch neoprene acoustical friction pads between bottom baseplate and the supporting surface; leveling bolts; provision for bolting the mount to the equipment (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; 1-inch minimum static deflection (unless otherwise specified); welded steel housing; vertical clearance of 1/8 to 3/8 inch shall be maintained between spring top plate and housing (leveling bolts shall be adjusted to maintain this clearance). Submittal shall include spring diameters, deflections, free spring heights, solid spring heights and operating heights. Be similar to Mason Type C.
- E. Neoprene and Spring Hangers, Vertical Deflection (Unit NSHV): Steel housing for undampened support of the spring: Provisions for attachment of hanger rods; reinforced neoprene washer and grommet to break up metal to metal contact; free standing spring; 1 inch minimum static deflection (unless otherwise specified) spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection. Submittals shall include spring diameters, solid spring heights, free spring heights, deflections, overall hanger dimensions and maximum hanger rod diameter which can be accommodated by the hanger. Be similar to Mason Type DNHS: Amber-Booth Type BSR.
- F. Neoprene and Spring Hangers, Vertical and Angular Deflection (Unit NSHVA): Shall contain a laterally stable steel spring and 0.3" reflection neoprene or fiberglass element in series. A neoprene neck shall be provided where the hanger rod passes through the steel box supporting the isolator mount to prevent metal to metal contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree 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. Mason Type 30N.
- G. Neoprene and Spring Hangers, Vertical Deflection, Position Type (Unit NSHVP): Steel housing for undampened support of the spring; provisions for attachment of hanger rods; reinforced neoprene washer and grommet to break up metal to metal contact; free standing spring; 1 inch minimum static deflection (unless otherwise specified); spring diameters not less than 0.8 of the compressed height of the spring at rated load; springs shall have a minimum additional travel to full compression of 50% of the rated deflection; be capable of holding the supported item at fixed elevation during installation with secondary adjustment to transfer the load to the spring while maintaining a fixed position; scale and pointer to indicate the deflection. Submittals shall include spring diameters, solid spring heights, free spring heights, deflections, overall hanger dimensions and maximum hanger rod diameter which can be accommodated by the hanger. Be similar to Mason Type PCDNHS: Amber-Booth Type PBS.
- H. Neoprene and Spring Hangers, Vertical and Angular Deflection, Position Type (Unit NSHVAP): Shall contain a laterally stable steel spring and 0.3" deflection neoprene or fiberglass element in series. A neoprene neck shall be provided where the hanger

- rod passes through the steel box supporting the isolator mount to prevent metal to metal contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree 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. Be capable of holding the supported item at the fixed elevation during installation with secondary adjustment to transfer the load to the spring while maintaining a fixed position; scale and pointer to indicate the deflection; similar to Mason Type PC30N.
- I. Neoprene-In-Shear Hangers (Unit NH): Steel housing for undampened support of the neoprene; provisions for attachment of hanger rods; neoprene-in-shear isolator; similar to Mason Type HD, Amber-Booth Type HRD.
- J. Neoprene-In-Shear Mounts (Unit NM): Double deflection neoprene-in-shear mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene-covered. The top and bottom surfaces shall be neoprene ribbed and bolt holes shall be provided in the base. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang; steel rails shall be by same manufacturer as vibration isolators and equivalent to Mason Industries Type DNR. Mounts shall be Mason Industries Type ND, Consolidated Kinetics Type RD or Vibration Mounts and Controls Series RD.
- K. Flexible Pipe Connectors: Same internal diameter as the pipe in which the connector is installed (not necessarily internal diameters of inlets or outlets of equipment).
1. Both recommended by the manufacturer and approved by the Architect/Engineer to be suitable for handling the conveyed fluid at all conditions (maximums and minimums of temperatures, pressures, velocities, etc.) encountered for each particular application.
  2. Of proper design to absorb the combination of vibratory and/or expansion or contraction motions (lateral and/or axial and/or angular) encountered at each installation point (for example, do not use hose type where axial motion is encountered at the installation point unless so recommended by the manufacturer and approved by the Architect.
  3. Stainless steel bellows type (Unit SSB): Heavy duty steel restraining rods and spacers; laminated steel bellows; steel flanges; permit axial, lateral and angular movement; rated to withstand 180°F operating temperature and 150 psig working pressure for chilled water; 250°F operating temperature and 150 psig working pressure for heating hot water; similar to Keflex Series 151 or 301.
  4. Stainless steel hose type (Unit SSH): Rated to withstand 180°F operating temperature and 150 psig working pressure; have flanges except 2-1/2 inch and smaller sizes may have screw type fittings installed with a union at one end or with screw-on flanges at both ends; net flexible lengths shall be at least 6 pipe diameters for pipe up to 5 inch ID and not less than 36 inches for pipe 6 inch ID

and greater; corrugated bellows with stainless steel wire braid restraining sheath; similar to Flexonics Type RW, RF or Series 400, Mason Type BSS, Keflex Series SSH.

- L. Acoustic Seals (Unit AS): Consist of an S-shaped molded synthetic rubber seal attached with stainless steel clamps to the pipe wall sleeves and to carrier piping. Wall sleeves shall be two pipe sizes larger than the carrier pipe and/or its insulation. Amber-Booth Type 301.
- M. Inertia Bases (Unit IB):
1. Weigh at least 1.5 times the weight of the particular machine being supported.
  2. Rectangular welded structural channel steel perimeter frame.
  3. Reinforced concrete.
  4. Height saving support brackets.
  5. Width and length at least 6 inches beyond machine's overall width and length (if necessary, larger for pumps as required to support suction and discharge wells).
  6. Structural steel channel depth and concrete base depth shall be a minimum of 1/15th of the longest base dimension but not less than 6 inches.
  7. Forms shall include 1/2 inch (or larger if necessary) steel reinforcing bars welded in place on 6 inch centers running both ways across the width and length in a layer 1-1/2 inches above the bottom of the base. Drilled steel members with sleeves welded below the holes to receive equipment anchor bolts.
  8. Similar to Mason Type KSL Base.
- N. Steel Equipment Frames (Unit SEF): Frames shall consist of structural steel sections sized, spaced and connected to form a rigid base which will not twist, rack, deform or deflect in any manner that will negatively affect the operation of the supported equipment or the performance of the vibration isolation mounts. Frames shall be of adequate size and plan form to support basic equipment units and motors plus any associated pipe elbow or duct elbow supports and electrical control elements or other components closely related and requiring resilient support in order to prevent vibration transfer from equipment to the building structure. Frames shall include side mounting brackets for attachment to Unit SMOU isolator or other specified isolator. The clearance between the underside of any frame or mounted equipment unit and the top of the building structure below shall be at least 2 inches.
- O. Neoprene Pads (Unit NP): Waffle or ribbed pattern neoprene pads shall be fabricated from 40-50 Durometer neoprene. Mason Type W.
- P. Isolation rails, curb mounted, for roof mounted air handling units (Unit IRCM): Curb mounted roof top units shall each be isolated with a continuous roof top isolation assembly consisting of extruded aluminum rails formed to fit curb and equipment

with a flexible air and weather seal continuously joining the two rails and incorporating spring isolators sized for 1" static deflection. Flexible weather seals shall be 1/16th inch thick minimum reinforced Neoprene protected from direct sunlight and accidental puncture by an extruded aluminum shield and shall be capable of being replaced completely without disturbing the unit mounting. Springs shall be stable with a KX/KY (horizontal to vertical spring rate) of 1.0 or greater and be properly sized to support the load at 1" static deflection. Isolation assembly shall have Neoprene cushioned wind restraints which are not engaged in normal operation with sufficient capacity to resist wind load in any direction without distortion or damage to the isolated equipment. Entire assemblies shall be shipped in one piece to eliminate field joint and possible leakage. Mason Industries CMAB.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. All isolators shall be installed in strict accordance with the manufacturer's instructions and shall be properly adjusted prior to requesting final inspection or the performance of any vibration testing specified.
- B. Each item of equipment (machinery, piping, etc.) which is provided with vibration isolation equipment shall rest in its intended, proper operating position (i.e. exactly level, etc.) after installation of vibration isolation equipment. Approval of such vibration isolation equipment by Architect/Engineer shall not relieve the Contractor of this responsibility.
- C. Equipment which is specified to rest on concrete housekeeping pads shall have Unit NP pads unless otherwise indicated.

#### 3.2 PIPING IN AIR HANDLING UNIT EQUIPMENT ROOMS

- A. General:
  - 1. Isolators for equipment are described elsewhere in this specification; and it shall be the responsibility of the vibration isolation manufacturer to coordinate the selection of piping supports with equipment supports to provide for a carefully engineered system designed to accommodate expansion and contraction without creating excessive stress at any equipment connections or in any portion of the piping.
  - 2. Hangers for horizontal piping shall be installed at regular intervals. Pipe risers shall be supported at the base of the riser. Submit hanger schedule.
  - 3. The first three piping supports away from any given piece of vibrating equipment to which piping is connected shall be selected for an operating spring deflection not less than that specified for the equipment isolators. All other vibration

isolation supports for horizontal piping shall have a minimum operating deflection of 3/4" with capability of 50% additional travel-to-solid. All supports for pipe risers shall have deflection capability at least four times the expansion or contraction to be accommodated.

4. Temporary anchors, where required, shall be installed to permit pre-adjustment of springs in risers. Pre-adjustment procedure, which is intended to control direction of pipe movement and final operating deflection of the springs, shall be detailed in submittal data.
5. Permanent limit stops shall be installed to prevent excessive vertical motion of risers in the event water is drained from system. Locations and other details of these limit stops shall be submitted to Architect/Engineer for acceptance.
6. Piping connected to vibration isolated equipment shall be installed so that it does not strain or force out of alignment vibration isolators supporting the basic equipment, nor shall pipes restrict such equipment from "floating" freely on its respective vibration isolation system.
7. Drain piping connected to vibrating equipment shall not physically contact any building construction or non-isolated systems or components.
8. Do not allow the weight of the pipe to be carried by walls through which the pipe passes.

B. Isolator Locations:

1. Ceiling hung piping to air handling units: Provide neoprene and spring hangers, vertical and angular deflection (Unit NSHVA) at the first three support points of pipe runs connected to the vibrating equipment or at all support points along the first 50 feet of pipe runs connected to the vibrating equipment, whichever length is greater, but not to exceed length of mechanical equipment room.
2. Floor supported piping to air handling units: Provide resilient support for floor supported piping same locations as specified above for ceiling hung piping. Provide open type unrestrained spring mounts (Unit SMOU) for first three support points; use neoprene-in-shear mounts (Unit NM) thereafter and both with supplemental supports as required by job conditions.
3. Acoustic Seals: Provide acoustic seals (Unit AS) at all wall, ceiling and floor openings through which pipe runs from equipment rooms into adjoining spaces.

3.3 PIPING IN MAIN CENTRAL MECHANICAL EQUIPMENT ROOM

A. General: The requirements of the paragraph entitled "General", in the above article entitled "Piping in Air Handling Unit Equipment Rooms" shall also apply. Also, the following is applicable:

1. In order to be certain that the piping weight is properly distributed and not distorting the machine flanges, the first four hangers from each machine connection shall be position hangers.

B. Type and Extent of Piping to Isolated:

1. All piping connected to any kind of pump, pump assembly, chiller, air compressor assembly, air handling unit, or other type of vibrating equipment shall be isolated as follows. This includes (but is not necessarily limited to) piping conveying chilled water, condenser water, condensate, domestic water, fire protection water, make-up water and compressed air.
2. This spring isolation shall be continuous throughout the piping systems of the main central mechanical equipment room.

C. Basic Isolator Types:

1. Floor Supported Piping: Unit SMOU, SMOR or SMHU, as applicable.
2. Piping Suspended from Above: Units NSHVA or NSHVAP, as applicable.
3. Static Deflection: As recommended by the vibration isolation manufacturer as dependent upon size, length and weight of applicable piping and its conveyed fluid.
4. Acoustic Seals: Provide acoustic seals (Unit AS) at all wall, ceiling/floor openings through which pipe runs into adjoining spaces.

### 3.4 AIR HANDLING UNITS, FACTORY PACKAGED

A. Floor Mounted:

1. Spring mounted (Unit SMOU) with 1 inch minimum static deflection when AHU motor is 5 hp. or less; spring mounts with 2 inch minimum static deflection when AHU motor is 7-1/2 hp. or greater. Instead of bolting the units to the spring mounts, provide height saving brackets.
2. Flexible duct connections as specified in "Duct System Accessories" section.
3. Flexible pipe connectors (Unit SSB).
4. Steel equipment frame (Unit SEF) manufacturer's standard unit frame or base is not sufficiently stiff and rigid to permit point vibration isolation.

5. Mount equipment on reinforced concrete pads as specified in other sections.
- B. Suspended from Building Structure:
  1. Spring hangers (Unit NSHV) with 1-inch minimum static deflection when motor is 5-HP or less; spring hangers (Unit NSHV) with 2-inch minimum static deflection when motor is 7-1/2 HP or greater.
  2. Flexible duct connectors as specified in Section entitled "Ductwork".
- 3.5 FAN COIL UNITS AND FANS, IN-LINE CENTRIFUGAL LIGHT DUTY AND HEAVY DUTY
  - A. Flexible duct connectors as specified in "Ductwork".
  - B. Neoprene-in-shear hangers (Unit NH).
  - C. Piping (first 10 feet) with neoprene hangers (Unit NH).
- 3.6 FANS, IN-LINE CENTRIFUGAL HEAVY DUTY
  - A. Suspended from Structure:
    1. Spring hangers (Unit NSHV) with 1-inch minimum static deflection when motor is 5 HP or less; spring hangers (Unit NSHV) with 2-inch minimum static deflection when motor is 7-1/2 HP or greater.
    2. Flexible duct connectors as specified in Section entitled "Ductwork".
- 3.7 FAN INDUCTION TERMINAL UNITS
  - A. Flexible duct connectors as specified in "Ductwork".
  - B. Neoprene-in-shear hangers (Unit NH).
- 3.8 PUMPS, HORIZONTAL BASE MOUNTED
  - A. Inertia bases (Unit IB).
  - B. Spring mounts (Unit SMOU or SMOR as applicable) with 2-inch deflection.
  - C. Flexible pipe connectors (Unit SSB).
- 3.9 CHILLERS, CENTRIFUGAL
  - A. Mount on neoprene pads (Unit NP) on concrete housekeeping pad.
  - B. Flexible pipe connectors (Unit SSB) at CHW and CW connections.



3.10 TEMPERATURE CONTROL AIR COMPRESSOR

- A. Spring mounts (Unit SMOU) with 1.0 inch deflection.
- B. Flexible pipe connectors (Unit SSH).

3.11 MANUFACTURER'S SUPERVISION

- A. The Contractor shall include in his price the cost of the vibration isolation manufacturer or his qualified representative for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after system is put into operation, the manufacturer or his representative shall make a final inspection and submit his report to the Architect/Engineer in writing certifying the correctness of installation and compliance with approved submittal data.

END OF SECTION

## SECTION 230553 - IDENTIFICATION OF PIPING SYSTEMS AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide complete identification of the mechanical systems including piping, valves and equipment as noted herein.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Divisions 21, 22 and 23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Piping and the interconnected equipment and component items for the following systems:
    - a. Chilled water.
    - b. Hot water.
    - c. Steam.
    - d. Compressed air.
    - e. Insulation.

#### 1.4 APPLICABLE PIPING AND RELATED ITEMS

- A. Piping and interconnected equipment and component items for the following systems shall be identified. Identification of the following systems shall not preclude the identification of other systems where identification of such other systems may be specified in other sections. Systems requiring identification as work of this section are:
  - 1. Chilled water.
  - 2. Hot water.
  - 3. Steam.

#### 1.5 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Provide schedule of colors, lettering, tagging, handling and similar items to clearly identify proposed method of identification for mechanical systems.

## 1.6 DIMENSIONS

- A. Pipe dimensions as used in this section refer to the total outside dimensions (diameters) of both the pipe and its insulation (if any).

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Comply with ANSI A13. 1-1975, "Scheme for Identification of Piping Systems" and OSHA requirements, or as otherwise indicated.
- B. Acceptable Manufacturers: W. H. Brady Co., 2223 West Camden Road, Milwaukee, WI 53201; Seton Name Plate Corporation, 592 Boulevard, New Haven, CT 06505, or equivalent.

### 2.2 MARKERS, BANDS, TAGS AND LABELS

- A. Markers: Must have approved color coded background, proper color of legend in relation to background color, approved legend letter size, approved length and flow arrow indicator.
  - 1. Pipes 3/4" through 5" O.D.: Seton "Setmark" Type SNA marker or equivalent.
  - 2. Pipes 6" O.D. and Greater: Seton "Setmark" Type STR marker or equivalent.
- B. Bands: Color coded in minimum widths of 2-1/4" for pipe through 12" O.D. and 4" for pipe 14" O.D. and greater. Brady B-500 Vinyl Cloth, B-350 PermaCode or B-946 Outdoor Film or equivalent as applicable.
- C. Valve Tags: Each tag shall designate appropriate service and valve number. Be securely attached with meter seals with 4-ply 0.018 copper smooth wire, or brass "S" hooks, or brass jack chain in a manner to allow easy reading. Provide either of the following types:
  - 1. Brass Type: Minimum 19 gauge polished brass; 1-1/2" min. diameter. Acceptable: Seton Style 250-BL or equivalent.
  - 2. Aluminum Color Coded Type: Anodized aluminum; 2": min. diameter. Acceptable: Seton Style 2070 or equivalent.

3. Aluminum Alloy Type: 16 gauge sheet aluminum: depressed type letters filled with black enamel. Face and periphery of satin finish Alumilite, Alcoa 204A2 or equal, free from burns and scratches. Seton Type 4 or equivalent.
  4. Fiber Glass Type: 1/16" thick glass fiber reinforced resin. 2" x 2" size of 2-1/2" x 9" size as necessary to identify item. Brady Series No. 2297 or equivalent.
- D. Labels: Provide either of the following types:
1. Plastic Type: Outdoor grade acrylic plastic to withstand weather, abrasion, grease, acid, chemical and other corrosive conditions; 1/16" min. thickness. Sized 3/4 x 2-1/2, 1 x 2-1/2, 1 x 3 or 1-1/2 x 4 as necessary to identify item. Seton "Setonite" or equivalent.
  2. Aluminum Type: Engraved, flexible, 0.020" thick aluminum. Sized 3/4 x 2-1/2, 1 x 3, 1-1/2 x 4 or 3/6 as necessary to identify item. Seton No. 06505 or equivalent.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Apply only after completion of insulation, painting and cleaning work so that final identification is not disfigured by such other work.
- B. Coordinate with actual composition and operating temperatures of surface on which identification is to be placed so that proper permanent adhesion of markers and labels to surface is obtained.
- C. Locate marking and banding where practical such that groups of pipe are identified at similar location for ease of visual tracking. For example, mark and band parallel runs of pipe which are side-by-side at the same general place.
- D. Small pipes less than 3/4" diameter may be identified with tags similar to those specified for valves.
- E. Adhere or affix all identification items permanently except where removal may be necessary for maintenance or service.

### 3.2 MARKERS AND BANDS

- A. Provide on piping as follows:
  1. Pipe Concealed in Inaccessible Locations (e.g., Chases, Underground): No identification required.
  2. Pipe Concealed in Accessible Locations (e.g., Ceiling Plenums):
    - a. Markers every 30 feet of pipe length. Bands every 15 feet of pipe length.

3. Pipe Exposed in Equipment Rooms:

- a. Markers every 15 feet of pipe length for pipe through 12 inches O.D. and every 30 feet for pipe 14 inches O.D. and greater.
4. Bands every 10' of pipe length for pipe through 12" O.D. and every 25' for pipe 14" O.D. and greater.
5. Exterior Pipe, Exposed: No identification required unless otherwise indicated.

3.3 VALVE TAGS

A. Valve tags shall be installed on the following items:

1. All motorized valves (except those valves associated with direct control of flow to air handling apparatus whereby the valve may be identified by reference to the item of equipment it serves).
2. All fire protection system valves located in mains and branches (except those valves in fire hose cabinets).
3. All manual valves which perform functions other than isolation of an equipment item for servicing. This includes, but is not limited to, valves in valve stations, remote locations where use is not evident due to proximity of equipment or other piping, and similar locations.
4. Small piping (other than domestic water) where markers are impractical.
5. Small but critical equipment items on which it is impractical to install labels.

3.4 VALVE TAG LISTS

A. Prior to substantial completion, provide a complete list of all valves having tags. Indicate the following on such list:

1. Valve size.
2. Valve location.
3. Valve type.
4. Service application.
5. Valve manufacturer and model number.
6. Pressure class and allowable working pressure.

3.5 LABELS

- A. Provide labels of proper size on mechanical system equipment including but not limited to, pumps, chillers, tanks, major piping components such as air separators, air handling equipment, fans, control panels, terminal units, flow stations, reheat coils and similar items.

### 3.6 COLORS

- A. Colors for piping systems and equipment which are required to be painted shall be as follows for those systems which may be applicable to this project:
1. Domestic Cold Water: Medium green enamel with domestic cold water legend.
  2. Domestic Hot Water and Domestic Hot Water Recirculation: White insulation with yellow tape or metal bands with domestic hot water (domestic hot water recirculation) legend.
  3. Chilled Water Piping: Blue mastic with blue tape or bands with chilled water supply (or return) legend.
  4. Heating Hot Water Piping: Burnt orange with heating hot water supply (or return) legend.
  5. Gas Piping: Yellow with gas legend.
  6. Compressed Air Piping: Light grey with compressed air legend.
  7. Fire Protection Piping: Red with fire line legend.
  8. Sprinkler Piping: Red with sprinkler legend.
  9. Condenser Water Piping: Tan with condenser water supply (or return) legend.
  10. Roof Drainage Piping: Light green with storm water legend.
  11. Compressed Air Piping: Black with compressed air legend.
  12. Natural or L.P. Gas Piping: Yellow with gas legend.
  13. High (or Medium or Low) Pressure Steam Supply Piping: White insulation jacket or aluminum jacket with yellow tape or bands with HP (MP, L.P.) steam legend.
  14. High (or Medium or Low) Pressure Steam Condensate Piping: White insulation or aluminum jacket with yellow tape or bands with HP (MP, LP) steam legend.
  15. Equipment Hot Vent Piping (Below 100°F): Light brown with vent legend.
  16. Equipment Hot Vent Piping (Above 100°F): Light brown tape or bands over insulation or metal jacket with vent legend.
  17. Vacuum (Housekeeping): Light olive green with vacuum legend.
  18. Fuel Oil (Supply, Return, Vent) Piping: Yellow with fuel oil legend.

19. Generator Exhaust Piping:

- a. Insulated: White insulation with yellow tape or band with generator exhaust legend.
- b. Bare Pipe and Fittings: Silver (suitable for extra high temperature application).

20. Sanitary Sewer and Vent Piping: Brown with sanitary sewer (vent) legend.

21. Electrical conduit (not specified as painted in other divisions of these specifications): Silver.

B. Identification: Coordinate colors and finishes with pipe identification.

END OF SECTION

## SECTION 230700 - INSULATION, HVAC

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide all work necessary to insulate all equipment, piping, ducts and other items related to the piping and duct systems.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Piping systems.
  - 2. Duct systems.
  - 3. Heat generating equipment.
  - 4. Heat exchange equipment.
  - 5. Cooling equipment.
- C. Vessels, tanks, stacks, and other items which contain or convey fluids which are at such temperatures as to create condensation or surface temperatures which are hazardous or where heat loss or gain prohibits proper system operation.

#### 1.4 SHOP DRAWINGS

- A. General: Refer to the Section entitled "General Mechanical Provisions". Shop drawings shall contain complete descriptive and engineering data, including flame spread and smoke developed ratings (ASTM E84 test method) on all materials and adhesives. Where finishes, covers, or jackets are specified, provide complete data on same. Shop drawings shall contain specified information on: densities, conductivities, conductances, or resistances as required to establish conformance with the specified values or materials.
- B. Industry Standards: Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.
- C. Commencement of Work: Submit shop drawings before any work is commenced.



## 1.5 STORAGE OF MATERIALS

- A. Do not store fiberglass insulation within the building until it has been "dried in". If no other dry space is available and this insulation must be installed or stored before the building is "dried in" and completely enclosed, provide polyethylene film cover for protection.

## 1.6 COMPLIANCE WITH CODES AND STANDARDS

- A. Applicable Codes: The total insulation system including insulation, sealant, finishes, etc., shall comply with or exceed all code requirements.
- B. NFPA: All materials and adhesives used shall conform to the requirements of NFPA 90A as to flame spread and smoke developed ratings.

## 1.7 DEFINITIONS AND TERMINOLOGY

- A. Terminology: Throughout this section, insulation products may be described as regards the location, surface or other point at which they are to be applied. Except in special cases (where a detailed indication or description will be given), the majority of conditions can be defined in whole or in part by use of (but not necessarily limited to) any or all of the following words:
  - 1. "Internal" or "External".
  - 2. "Interior" or "Exterior".
  - 3. "Concealed" or "Exposed".
  - 4. "Protected" or "Unprotected".
- B. Definitions: Wordage used to describe locations, surfaces or other points or conditions shall be defined as follows as related to this section. Where the ascertainment or determination of locations, surfaces and other conditions is obvious from the intent of use of the item (e.g., roof-mounted ductwork, underground piping, etc.) or from other information, then the following words may not be required. If any ambiguity should occur, provide bid based on the most severe condition; however, obtain clarification from Architect/Engineer prior to installation:
  - 1. "Internal" and "External": Relates to an item or its surface which is to be insulated or uninsulated. Does not relate to the confines of the building, structure or other entity in which the item is located. (Examples: internal/external surfaces of ductwork, pipe, air handling units or other such items.)
  - 2. "Interior": Relates to the location of an item as to whether the item is within a heated, ventilated, air conditioned or otherwise controlled environment of the building, structure or other entity in which the item is located. "Interior" is always "Protected". (Examples(s): Interior ductwork, interior piping, interior air handling units.)

3. "Exterior": Relates to the location of an item as to whether the item is outside (i.e., exterior to) a heated, ventilated, air conditioned or otherwise controlled environment of the building, structure, facility or other entity which the item serves or relates. "Exterior" generally means that the item is surrounded by the ambient outside environment. "Exterior" is considered "Unprotected" unless otherwise described. (Examples(s): exterior rooftop air handling units, exterior ductwork, exterior cooling tower.)
4. "Concealed" and "Exposed": Relates to the visibility of an item. "Concealed" implies out-of-sight from normal view by an occupant, user or employee of the facility when such person is performing their normal function. "Exposed" implies that the item is readily visible by such a person when that person is performing a normal function. (Examples(s): "Concealed interior ductwork" would be out-of-sight in a ceiling plenum, whereas "exposed interior ductwork" would be readily visible in a mechanical equipment room or in a room which intentionally had no ceiling system.)
5. "Protected" and "Unprotected": Relates to an exterior item which may or may not be sheltered from the outside elements but which exists in contiguous contact with the ambient environment without benefit of any direct heating, ventilating or air conditioning. (Example(s): Piping or ducts located in an open crawl space beneath a building would be "protected/concealed"; in an open parking garage such piping or ducts would be "protected/exposed". Piping or ducts on a rooftop would be "unprotected" and usually "exposed".)

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Materials: Materials listed are those used as basis of design; equivalent products of acceptable manufacturers will be accepted. Materials must be approved and recommended by the insulation product manufacturer for the particular application(s).
- B. Flame and Smoke Ratings: Application of insulation materials may require, in many cases, that the final insulation system comply with NFPA 90A with regard to maintaining a flame spread rating of 25 or less and a smoke developed/fuel contributed value of 50 or less. In such cases, verify that the materials comply with the indicated flame spread and smoke developed ratings.
- C. Applicability: Products and manufacturers listed may not all be applicable. Use only those products and manufacturers which are indicated as being applicable to a specific insulation condition.
- D. Acceptable Manufacturers: Manufacturers which are listed are those manufacturers who may make one or more of the insulation products required. Listing of a manufacturer does not necessarily mean the manufacturer is approved for all applicable insulation conditions. Each listed manufacturer must still comply with the

specific requirements of each insulation condition to be acceptable for the particular application. Acceptable manufacturers of insulation-related products include (but are not necessarily limited to) the following: Armstrong; CertainTeed; Childers Products Co.; Knauf; Manville; Owens-Corning; Pittsburg Corning; Rubatex; Upjohn Co.; Duracote Corporation; Ferro Corporation; Dow Corning Corporation; Duro Dyne Corporation; Goodloe E. Moore, Inc.; 3M Co.; United McGill Corporation, Vimasco Corporation; Foster; Gustin-Bacon; Nomaco Inc.; Insulcoustic; Molded Acoustical Products; Lion Nokorode and other manufacturers as may be listed for a specific application.

## 2.2 BASIC MATERIALS

- A. Cellular Glass Insulation: Preformed or block type as indicated or as applicable. Fire, water and vermin retardant; closed cell glass composition; density of 8.5-pcf. Comply with the following: ASTM C 552, "Specification for Cellular Glass Thermal Insulation"; Military Specification MIL-I-24244B. Flame spread rating of "5" and a smoke developed rating of "0" as per ASTM E 84. Recommended temperature applications from -450°F to 1200°F when installed in accord with manufacturer's recommendations. Pittsburg-Corning Foamglas.
- B. Elastomeric Insulation: Preformed (tube), roll or sheet as indicated or as applicable. Nitrile, rubber based, closed cell structure. K factor of 0.28 at 75°F. In tube, roll or sheet form of 3/4-inch thickness or less, ASTM E 84 flame spread rating of "25" or less and smoke developed rating of "50" or less. Recommended temperature applications from -40°F to 220°F when installed in accord with manufacturer's recommendations. Do not install in return air plenums unless flame spread rating and smoke developed rating are within constraints of applicable codes. Manufacturers and/or series: Armstrong "Armaflex"; Manville "Aerotube"; "Rubatex"; Gustin-Bacon "Ultra-Foam".
- C. Fiberglass Insulation: Inorganic fibrous glass. Flame spread of "25" or less and smoke developed rating of "50" or less per ASTM E 84.
  - 1. Board: Rigid or semi-rigid form, faced or unfaced as indicated. Stiffness of 475 EI, 800 EI or 1400 EI as indicated.
  - 2. Blanket: Flexible form; faced, unfaced or coated as indicated.
  - 3. Preformed: Jacketed or unjacketed as indicated.
- D. Calcium Silicate Insulation: Preformed or block type as indicated or as applicable. Asbestos free. Rigid hydrous calcium silicate. K factor of 0.42 at 200°F. Density: 14-pcf. Flame spread rating of "0" and smoke developed rating of "0" as per ASTM E 84. Recommended temperature applications up to 1200 °F. Use where indicated only on equipment and surfaces which generate heat; do not use as a cold-surface insulation.

## 2.3 INSULATION PRODUCTS, BASIC

- A. Type PI-1: Pipe insulation, preformed cellular glass. Pittsburg-Corning "Foamglas" or equivalent.
- B. Type PI-2: Pipe insulation, preformed jacketed fiberglass. Jacketed with factory-applied kraft reinforced foil vapor barrier jacket. Jacket closure system of double pressure-sensitive adhesive on longitudinal joints; self-sealing butt strips at circumferential joints; provide positive vapor barrier seal. Thermal conductivity (K) of 0.24 at 100°F. Owens-Corning Fiberglas ASJ/SSL-II; Manville Micro-Lok with AP-T Plus jacket; CertainTeed 500 Snap-On; or equivalent.
- C. Type PI-3: Pipe insulation, preformed unjacketed fiberglass. Suitable for field-jacketing. Thermal conductivity (K) of 0.23 at 100°F. Owens-Corning Fiberglas No-Wrap, Manville Micro-Lok, or equivalent.
- D. Type PI-4: Pipe insulation, preformed segmental rigid calcium silicate. Thickness as indicated; provide single layer where nominal pipe size allows; provide "factory nested" double layer when nominal pipe size so requires for the thickness indicated. Owens-Corning Kaylo; Manville Thermo-12; or equivalent.
- E. Type PI-5: Pipe insulation, preformed elastomeric. Rubatex, Armaflex II or equivalent.
- F. Type I-1: Cellular glass block insulation. Field formed, fitted and finished as required for the application. Pittsburg-Corning Foamglas or equivalent.
- G. Type I-2: Calcium silicate block insulation. Field formed, fitted and finished as required for the application. Owens-Corning Kaylo; Manville Thermo-12; or equivalent.
- H. Type I-3: Elastomeric insulation. Field formed, fitted and finished as required for the application. Armaflex, Rubatex or equivalent.
- I. Type I-4: Fiberglass flexible blanket insulation. Unfinished, non-combustible, wool-like; composed of long glass fibers bonded with a thermosetting resin. Thermal conductivity (K) of 0.23 at 100°F. Applicable where indicated for boilers, vessels, breaching and stacks operating at up to 1000°F. Finished or held in place by wire ties, metal lath, lagging or as indicated. Owens-Corning Thermal Insulating Wool TIW Type II or equivalent.
- J. Type DI-1: Duct insulation, fiberglass flexible blanket wrap. Composed of flexible blanket of glass fiber factory laminated to a reinforced foil kraft (FRK) vapor barrier with a minimum 2-inch taping and stapling flange on one edge. Suitable for operation at temperatures from 40°F to 250°F. Thermal conductivity of 0.31 at 75°F. Minimum density of three-quarter (3/4) pound per cubic foot. Provide in thickness of (2.2) inches unless otherwise specified as 2-1/2 or 3-inch thickness. Owens-Corning

All Service Faced Duct Wrap; Manville R-Series Microlite; CertainTeed Standard Duct Wrap; or equivalent.

- K. Type DI-2: Duct insulation, fiberglass semi-rigid board. Composed of resin bonded glass fibers faced with a foil scrim-kraft (FSK) reinforced laminate of aluminum foil and kraft bonded to provide a metallic surface finish vapor barrier; alternate vapor barrier facing (if specifically indicated) is an all service jacket (ASJ) of high intensity white bleached, chemically treated kraft paper reinforced with fiberglass yarn mesh and laminated to aluminum foil with fire-retardant adhesive to impart a clean, white appearance. Conductivity (K) of not greater than 0.23 at 75°F. Provide in thickness of one (1) inch unless otherwise indicated. Provide with minimum density of 3-pcf unless 6-pcf is specifically indicated. CertainTeed Industrial Insulation Board Type IB-300 (or IB-600); Manville 800 Series Spin-Glas Type 814 (or 817); Owens-Corning 700 Series Industrial Insulation Board Type 703 ( or Type 705); or equivalent.

#### 2.4 INSULATION ADHESIVES, MASTICS, SEALANTS

- A. Adhesive (Type A-E1): For joints and seams in elastomeric insulation (Type I-3) not requiring weather protection. Rubatex R-373 Insulation Adhesive; Armstrong 520 Adhesive or equivalent.
- B. Joint Sealant (Type JS-CG1): Non-hardening vapor barrier sealant specifically designed for use with cellular glass insulation (Types PI-1, I-1): Foster's 35-40 Foamseal Sealant, Pittsburg-Corning Pittseal 111 Sealant or equivalent.
- C. Adhesive (Type A-F1): For adhering fiberglass blanket and board insulations (Types DI-1, DI-2) to metal substrate such as ductwork. Insulcoustic I-C 201, Foster 85-20 or equivalent.
- D. Mastic, General Purpose (Type M-GP1): Non hardening vapor barrier general purpose mastic. For use where indicated or otherwise applicable. Foster GPM 35-00 or equivalent.

#### 2.5 INSULATION FINISHES, JACKETS AND COVERS

- A. Finishing Coating (Type FC-E1): For weather protection of elastomeric insulations (Types I-3, PI-5). Rubatex 374 coating; Armstrong Armaflex Finish or equivalent.
- B. Finish Mastic (Type FM-CG1): For cellular glass insulations (Types PI-1, I-1). Waterproof, weather, acid and alkali resistant asphalt mastic coating for use in the range of -40°F to 200°F (installation must be done when in the 50°F to 120°F range). Pittsburg-Corning Pittcote 300 Vapor and Weather Barrier Finish or equivalent.
- C. Finish Fabric (Type FF-CG1): For cellular glass insulations (Types PI-1, I-1). 6 x 6 meshes per inch polyester fabric for reinforcing the finish mastic. Pittsburg-Corning PC Fabric 79 or equivalent.

- D. Finish Fabric, General Purpose (Type FF-GP1): Nylon membrane. For use generally with fiberglass duct insulations (Types DI-1, DI-2) at joints or seams or as may be indicated. Apply using Foster GPM 35-00 or equivalent.
- E. Jacket, Underground Pipe (Type JP-CG-1): For cellular glass pipe insulations (Type PI-1, I-1) where indicated. Prefabricated laminate containing a 20 x 10 mesh asphalt impregnated glass fabric and a 1-mil thick aluminum foil sandwiched between three layers of a bituminous mastic. External jacket surface coated with a protective plastic film and internal surface with a special release paper. Apply around cellular glass pipe insulation in a cigarette type wrap with the overlap heat sealed. Seal butt joints in the same manner using a 4-inch wide seal strip of the jacketing. Irregular surfaces of the pipe system shall have the jacket's plastic film burned away prior to application of a 20 x 10 asphalt impregnated mesh which shall be sandwiched between two glove coats of finish mastic (Type FM-CG1).
- F. Jacket, Pipe, PVC (Type JP-PVC): All purpose, UL-rated, white vinyl jacket, with or without self-sealing feature. Pittsburg-Corning "UNI-JAC" or equivalent.
- G. Jacket, Pipe, Aluminum (Type JP-A1): Aluminum jacketing, 0.016 inches thick, type 3003 alloy, H-14 temper, circumferentially corrugated, with a continuously laminated moisture barrier of one mil polyethylene film and a protective layer of 40 lb. virgin kraft paper. Childers Products Co. "Corolon"; General Aluminum Supply Co. (Gasco); Insulcoustic "Alcorjac" or equivalent.
- H. Pipe Fitting Covers, PVC (Type PFC-PVC): Insulated polyvinyl-chloride fitting covers in shapes as required; with fiberglass insulation insert. Suitable for temperature range of 0°F to 450°F. Flame spread rating of 25 or less and smoke developed rating of 50 or less when kept below 150°F. Acid, alkali and chemical resistant. Suitable for painting if required. Manville Zeston 25/50 PVC Insulated Fitting Covers or equivalent.
- I. Pipe Fitting Covers, Aluminum (Type PFC-A1): Aluminum fitting covers, 0.020 inches minimum thickness, type 3003 alloy, H-14 temper prefabricated fitting covers with baked epoxy moisture barrier for pipe sizes through 24". Field fabricate fitting covers for pipe sizes larger than 24" using 0.020 inches thick aluminum roll jacketing with laminated polyethylene/kraft moisture barrier. Childers Products "Ell-Jacs", "Gore Ell-Jacs", "Tee-Jack", "End-Caps", and "Flange Jacs" or equivalent.

## 2.6 RELATED PRODUCTS

- A. Wire (Type W-1): Dead soft, 16-gauge, stainless steel.
- B. Straps (Type ST-1): Stainless steel T-304 (18-8) soft annealed with deburred edge with stainless steel wing seals. Childers Products "Febstraps" or equivalent.
- C. Tape (Type T-1): High tensile strength rope stock flat back paper pressure sensitive tape. Pittsburg-Corning "PC Tape No. 25" or equivalent.

- D. Screws (Type S-1): Aluminum pan head type "A" slotted #8 by 1/2-inch.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Field Forming, Fitting and Finishing: Where preformed insulation products are indicated as being acceptable for a particular application, provide field formed, fitted and finished insulation systems if such application is more practical (such as due to size, configuration or dimensions which may be outside of the availability ranges for size, dimension and/or thickness of preformed products).
- B. Pre-installation:
1. Do not apply insulation adhesives, materials or finishes until the item to be insulated has been completely installed and tested and proved tight and suitable for insulation.
  2. Prepare surfaces to be clean and dry before attempting to apply insulation.
- C. Insulation Shields: Provide hanger or pipe support shields of 16 gage (minimum) galvanized steel over or embedded in the insulation. Shield shall extend halfway up the pipe insulation cover and at least 6" on each side of the hanger. Securely fasten shield with pipe straps at each end.
- D. Valves, Cocks and Specialties: Insulate as for the related piping system in which they are located unless otherwise indicated.
- E. Factory Pre-insulated Components: Where equipment and other system components are specified in other sections to have factory installed insulation, then no additional insulation is required as work of this section unless additional non-factory-installed insulation is specifically described. Examples of such equipment and components which may not require additional insulation include, but are not necessarily limited to, boiler vessels, chiller evaporators, air handling units, airside terminal units, and similar items.
- F. Minimum Thicknesses: Insulation thicknesses which are indicated are minimum thicknesses. Contractor may provide the same insulation material in greater thickness as an aid to installation and handling procedures or due to material availability and procurement considerations.
- G. Branch Runouts: Branch runouts are considered to be individual supply/return pipes to individual terminal heating or cooling units (duct mounted coils, airside terminal units with heating coils, fan coil units, humidifiers, and similar small equipment). The supply/return pipe to such units is not considered to be a branch runout if the length of the supply or return pipe exceeds 12'-0" in length to the coil/unit connection.
- H. Steam Supply Piping Systems and Steam Condensate Return Piping Systems:

1. Supply Piping System: Shall be considered as the portion of the steam piping systems which conveys steam to a point of direct use at an equipment item which utilizes the steam for humidification or other useful purpose. Such piping conveys steam in or at its vapor phase condition.
2. Condensate Return Piping System: Shall be considered as all portions of the steam piping system which are not part of the steam supply pipe system. Such piping generally conveys steam condensate, exhaust or vented steam, feedwater, blowdown and similar forms of piping on the low pressure (downstream) side of steam traps and relief valves.
- I. Steam System Classifications: Steam systems of the following classifications shall be considered to operate within the following temperature and pressure ranges. See performance data scheduled, specified or shown for applicable operating conditions.
  1. Low pressure: 0 to 15-psig; up to 250°F.
  2. Medium pressure: Between 15-psig and 60-psig; between 251°F and 305°F.
  3. High pressure: Over 60-psig; between 306°F and 450°F.
- J. Insulation for Plumbing Systems: See other sections describing insulation for plumbing systems.

### 3.2 INSULATION THICKNESS FOR PIPING SYSTEMS

#### A. General:

1. Basis: Insulation thicknesses for piping are given for insulation installed in the locations indicated. Thicknesses are based on the various conditions of temperature, usage and environment which are typically encountered.
2. Applicable Thicknesses: All thicknesses as applicable to all conditions may not be given in this section article. Where an insulation thickness for a particular application is specified to be of other thickness than may be listed in this section article, "INSULATION THICKNESSES FOR PIPING SYSTEMS", then provide the insulation in the thickness indicated in other portion of this section which specifically describes the particular insulation application and its required insulation thickness. Thicknesses for other than piping insulation are given in the specific description of the particular application or description of the particular material used.
3. Ambient Conditions: Unless otherwise indicated, ambient conditions for the purpose of describing insulation thicknesses are related to cold applications to prevent condensation or excessive heat gain (e.g., chilled water pipe, cold vessels) and are related to hot applications to prevent harm to personnel or to prevent objectionable heat loss to the environment (e.g., hot water pipe, hot vessels, hot stacks).
  - a. These conditions are generally:



Interior: 80°F and 80% RH.  
Exterior: 90°F and 80% RH.

4. Thickness Requirements: Thicknesses are given below based on the following information:
- a. General type of fluid or process involved (e.g., chilled water, hot water, steam, refrigerant).
  - b. General location and, if necessary, conditions related to temperature (either or both internal or external to the insulation barrier) and ambient environment of the insulated item.
  - c. Pipe size range.
- B. Chilled Water Piping Systems: Fluid generally considered to be between 40°F and 65°F. Thickness is for cellular glass unless other insulation material is indicated.

Location or Description    Pipe Size (inches)    Insulation Thickness

Interior	Up to 1	1-1/2"
Interior	1-1/4 to 4	2"
Interior	6 and up	2-1/2"
-----	-----	-----
Exterior	Up to 4	2-1/2"
Exterior	6 and up	3"
-----	-----	-----
Underground	All Sizes	2"
-----	-----	-----

- C. Hot Water Piping Systems, Low Temperature: Fluid generally considered to be 200°F or less. Thickness is for fiberglass insulation except where annotated by the letter "G" in which case the insulation thickness is for cellular glass unless other insulation material is indicated. An asterisk (\*) indicates branch runouts.

Location or Description    Pipe Size (inches)    Insulation Thickness

Interior*	Up to 2	1/2"
Interior	Up to 2	1"
Interior	2-1/2 and up	1-1/2"
-----	-----	-----

Exterior, Protected	Up to 2	1-1/2"
Exterior, Protected	2-1/2 and up	2"
-----	-----	-----
Exterior, Unprotected	Up to 2	1-1/2"G
Exterior, Unprotected	2-1/2 and up	2" G
-----	-----	-----
Underground	Up to 4	2"G
Underground	5 to 14	2-1/2"G
Underground	16 and up	3"G
-----	-----	-----

- D. Steam Supply Piping Systems, Medium and Low Pressure: Fluid generally between 200°F and 305°F. Thickness is for fiberglass insulation except where annotated by the letter "G" in which case the insulation thickness is for cellular glass unless other insulation material is indicated. An asterisk (\*) indicates branch runouts.

Location or Description    Pipe Size (inches)    Insulation Thickness

Interior*	Up to 2	1-1/2"
-----	-----	-----
Interior; and Exterior, Protected	Up to 1	2"
-----	-----	-----
Interior; and Exterior, Protected	1-1/4 to 4	2-1/2"
-----	-----	-----
Interior; and Exterior, Protected	5 and up	3"
-----	-----	-----
Exterior, Unprotected	Up to 4	2"G
Exterior, Unprotected	5 and up	2-1/2"G
-----	-----	-----
Underground	Up to 4	2"G
Underground	5 and up	2-1/2"G
-----	-----	-----

- E. Steam Supply Piping System, High Pressure: Fluid between 306°F and 450°F. Thickness is for fiberglass insulation except where annotated by the letter "G" in which case the insulation thickness is for cellular glass unless other insulation material is indicated.

Location or Description    Pipe Size (inches)    Insulation Thickness

Interior; and

Exterior, Protected	Up to 2	2-1/2"
-----	-----	-----
Interior; and Exterior, Protected	2-1/2 to 4	3"
-----	-----	-----
Interior; and Exterior, Protected	5 and up	3-1/2"
-----	-----	-----
Underground	Up to 4	2"G
Underground	5 to 8	2-1/2"G
Underground	10 and up	3"G
-----	-----	-----

- F. Steam Condensate Return Piping System (including all related piping for steam vent, steam blowdown, and feedwater). Thickness is for fiberglass insulation except where annotated by the letter "G" in which case the insulation thickness is for cellular glass unless other insulation material is indicated. An asterisk (\*) indicates branch runouts.

Location or Description    Pipe Size (inches)    Insulation Thickness

Interior*	Up to 2	1"
-----	-----	-----
Interior; and Exterior, Protected	Up to 1	1-1/2"
-----	-----	-----
Interior; and Exterior, Protected	1-1/4 and up	2"
-----	-----	-----
Exterior, Unprotected	Up to 4	2"G
Exterior, Unprotected	5 and up	2-1/2"G
-----	-----	-----
Underground	Up to 4	2"G
Underground	5 and up	2-1/2"G
-----	-----	-----

### 3.3 CHILLED WATER PIPING SYSTEMS

- A. Interior, Concealed (e.g., ceiling plenums): Insulate with prefabricated, cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with a layer of fabric (FF-CG1) applied between two glove coats of mastic (FM-CG1). Mastic and fabric shall be applied in strict accordance with the manufacturer's recommendations.
- B. Interior, Exposed (e.g., central mechanical rooms, air handling unit rooms): Insulate with prefabricated, cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with jacketing (JP-A1). Secure jacketing with straps. Finish elbows and fittings with mastic (FM-CG1), reinforced with fabric (FF-CG1); or finish with fitting covers (PFC-

- A1). Finish materials shall be applied in strict accordance with the manufacturer's recommendations.
- C. Interior, Exposed, Special Locations: Same as for "Interior, Concealed" with the additional requirement that the final coat of mastic for the insulation finish shall be especially gloved and finished smooth to accept painting of color(s) required in other divisions as specially selected by the Architect/Engineer. These special locations consist of exposed piping in the following normally occupied areas of the building:
1. Gymnasium.
  2. Natatorium.
- D. Exterior, Protected: Same insulation system as for "Interior, Exposed" except thickness as required.
- E. Exterior, Unprotected: Same insulation system as for "Exterior, Protected" except thickness as required.
- F. Underground: Insulate with cellular glass pipe insulation (PI-1, I-1). Butter joints with joint sealant (JS-CG1) and secure each section with not less than two wires (W-1). Finish with underground jacket (JP-CG1) having 2-inch minimum overlap of the longitudinal seams. Heat seal longitudinal seams with a propane torch. Cover butt joints with a 4-inch wide strip of jacket with the edges heat sealed around the circumference. Precut the jacket to fit the contour or irregular surfaces such as 90° bends, 45° bends, fittings, etc. to which it is to be applied; in addition to heat sealing the jacket on these irregular surfaces, burn away the polyester film and glove a coat of mastic (FM-CG1) on the surface; while this coat is still tacky, embed a 10 x 10 asphalt impregnated fabric (FF-CG1) into the mastic. After this application has dried for not less than one hour, apply another coating of mastic. Caution: Keep mastic away from sparks and open flame and keep container closed when not in use.
- G. Underground Expansion Joints, Expansion Elbows and Expansion Loops: Provide oversized insulation telescoped over the adjacent pipe insulation to provide close fit and adequate annular space to allow all movement expected to be encountered through maximum temperature ranges (including idle) of the conveyed fluid. Provide 1-1/2 pcf density fiberglass pipe insulation of thickness equal to the cellular glass insulation beneath the oversized insulation to completely fill the annular space void and yet allow freedom of pipe movement. Comply with insulation manufacturer's recommendations for these conditions or with details on drawings, as applicable.

### 3.4 HOT WATER PIPING SYSTEMS

- A. Interior, Concealed: Insulate with glass fiber insulation (PI-2) with all purpose jacket. Elbows, joints, valves, unions and all like items shall be insulated using closely mitered insulation and wrapped with glass fabric and mastic or these items may be insulated and jacketed using pipe fitting covers (PFC-PVC). Install in strict accordance with the manufacturer's recommendations.

- B. Interior, Exposed: As specified for "Interior, Concealed", except finish with aluminum jacketing (JP-A1) and fitting covers (PFC-A1). Secure fitting covers with screws (S-1) and secure jacketing with straps (ST-1). Finish materials shall be applied in strict accordance with the manufacturer's recommendations.
- C. Interior, Exposed, Special Locations: Same as for "Interior, Concealed" with the additional requirement that the final coat of mastic for the insulation finish shall be especially gloved and finished smooth to accept painting of color(s) required in other divisions as specially selected by the Architect/Engineer. These special locations consist of exposed piping in the following normally occupied areas of the building.
  - 1. Gymnasium.
  - 2. Natatorium.
- D. Exterior, Protected: Same insulation system as for "Interior, Exposed" except thickness as specified.
- E. Exterior, Unprotected: None applicable.
- F. Underground: Same insulation system as for "Chilled Water Piping Systems" in this location except thickness as specified.
- G. Underground Expansion Joints, Expansion Elbows and Expansion Loops: Same as for "Chilled Water Piping Systems" in this location except thickness as specified.

### 3.5 STEAM SUPPLY PIPING SYSTEMS, LOW AND MEDIUM PRESSURE

- A. Interior, Concealed: Same insulation system as for "Hot Water Piping Systems" in this location except thickness as specified.
- B. Interior, Exposed: Same insulation system as for "Hot Water Piping Systems" in this location except thickness as specified.
- C. Exterior, Protected: Same insulation system as for "Interior, Exposed" except thickness as specified.
- D. Exterior, Unprotected: Same insulation system as for "Chilled Water Piping systems" in this location except thickness as specified.
- E. Underground: Same insulation system as for "Chilled Water Piping systems" in this location except thickness as indicated.
- F. Underground Expansion Joints, Expansion Elbows and Expansion Loops: Same insulation system as for "Chilled Water Piping Systems" in this location except thickness as specified.

### 3.6 STEAM SUPPLY PIPING SYSTEMS, HIGH PRESSURE

- A. Interior, Concealed: Same insulation system as for "Hot Water Piping Systems" in this location except thickness as specified.

- B. Interior, Exposed: Same insulation system as for "Hot Water Piping Systems" in this location except thickness as specified.
- C. Exterior, Protected: Same insulation system as for "Interior, Exposed" except thickness as specified.
- D. Exterior, Unprotected: None applicable.

### 3.7 DUCT SYSTEMS

#### A. General:

1. Locations and extent of both internal and external insulation for duct systems are described in section entitled "Ductwork" and/or by the "Duct Type and Location Schedule" on the Drawings.
  2. Internal Insulation: Ductwork which is required to be insulated internally (acoustically/thermally lined) shall be insulated as work of the section entitled "Ductwork".
  3. External Insulation: Ductwork which is required to be insulated externally shall be insulated as work of this section.
  4. Factory Insulation: Ductwork which is factory manufactured with internal or external insulation is not to be additionally insulated as work of this section unless specifically stated. Such factory insulated ductwork generally consists of flexible externally insulated ductwork and double walled acoustically thermally lined ductwork.
- B. Interior, Concealed (e.g., ceiling plenums): Where external insulation is required, insulate externally with 2.2 inch thick fiberglass blanket wrap (Type DI-1). Adhere duct insulation using adhesive (Type A-F1) applied in accordance with the manufacturer's recommendations. Where duct width exceeds twenty-four inches (24"), the insulation shall be additionally secured to the bottom of the duct using mechanical fasteners spaced one foot (1') on center. Insulation shall be applied with edges tightly butted, and all joints and breaks in the vapor barrier sealed using glass fabric and mastic applied in conformance with manufacturer's recommendations.
  - C. Interior, Exposed, (e.g., air handling unit rooms): Where external insulation is required, insulate with 1-inch thick semi-rigid fiberglass board (Type DI-2). Adhere to ductwork with adhesive (Type A-F1). Finish joints and seams with finish fabric (Type FF-GP1).

### 3.8 DUCT SYSTEMS EQUIPMENT

- A. General: Insulate as follows unless detailed to a greater extent on the Drawings.
- B. Fire damper and Fire/Smoke Damper External Surfaces:

1. Externally Insulated Duct Locations: Extend duct insulation up face of fire damper to damper sleeve. Seal insulation edges with 4-inch minimum width duct tape.
  2. Internally Insulated Duct Locations: Provide additional external insulation from a point on the duct 12 inches from the fire damper to the fire damper and on the face of the fire damper to the fire damper sleeve. Seal insulation edges with 4-inch minimum width duct tape.
- C. Air Distribution Devices: Insulate the backs of all ceiling diffusers and other air outlet devices installed in other than return air plenums as specified for interior concealed ducts.

### 3.9 COLD EQUIPMENT AND RELATED COMPONENTS

- A. Pump Volutes for Chilled Water Systems: Insulate with elastomeric sheet insulation (Type 1-3) out to and including pump flanges. Provide cutouts or removable sections as required to provide access to grease fittings and similar items and to allow adequate clearance for shaft. Secure the insulation with adhesive (Type A-E1). Insulation thickness shall be one and one-half (1-1/2) inches.
- B. Expansion Tanks(s), Air Separator(s) and Chemical Pot Type Feeder(s) for Chilled Water Systems: Insulate with elastomeric sheet insulation (Type 1-3). Secure the insulation with adhesive (Type A-E1) applied to a clean surface and finish with a layer of membrane (Type FF-GP1) applied between two glove coats of mastic (Type M-GP1). Insulation thickness shall be one and one-half (1-1/2) inch.
- C. Condensate Drain Piping From Cooling Equipment:
1. Interior, and Exterior, Protected: Insulate with preformed elastomeric pipe insulation (Type PI-5) secured with adhesive (Type A-E1) and finished with white finish coating (FCC-E1). Thickness 3/4-inch. Provide 25/50 flame/smoke rating.
  2. Exterior, Unprotected: None applicable.
- D. Cold Surfaces at Chillers and Evaporators: Factory insulated. No insulation required as work of this section.
- E. Flexible Pipe Connectors for Vibration Isolation: Insulate with elastomeric insulation (Type 1-3). Secure the insulation with adhesive (Type A-E1) applied to a clean surface and finish with white finish coating (FC-E1). Insulation thickness shall be one and one-half inches (1-1/2").

### 3.10 HOT EQUIPMENT AND RELATED COMPONENTS

- A. Heat Exchangers, Shell and Tube: Insulate with 2-1/2-inch thick calcium silicate insulation (Type -2). Wire insulation securely to vessel and then cover with wire

mesh. Apply a 1/2-inch thick finish coat of insulating finish cement over the wire mesh. Trowel external surface to a smooth finish.

END OF SECTION



## SECTION 230923 - DIRECT DIGITAL CONTROL SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Special Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide a completely functional Direct Digital Control (DDC) temperature control system, including, but not necessarily limited to:
  - 1. Controls for all items indicated on the drawings and described in this section, including thermostats, temperature transmitters, pressure sensors, valves, switches, relays, temperature control panels for instruments, and all associated wiring.
  - 2. Control valves and valve actuators, with pilot positioners as required.
  - 3. Automatic control dampers and electric damper operators.
  - 4. Direct Digital Control panels (Standalone Control Units), complete with power supplies, input/output boards, communications boards, and all other equipment required for a functional DDC system.
  - 5. Temperature sensors, pressure sensors, humidity sensors, start/stop relays, transducers, and any other auxiliary input/output devices required for a completely functional DDC system.
  - 6. Calibration adjustment, and startup of the temperature control system.
  - 7. Instruction of Owner's personnel on maintenance and operation of the temperature control system and DDC Panels.
  - 8. Composite electric control diagram showing interlocking equipment and interconnection with the DDC Control system.
  - 9. Associated electrical wiring and conduit.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

B. Electrical: Division-26.

1.4 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: Control system components shall comply with all legal requirements, including requirements of UL, NFPA, FM and FCC.
- B. Materials Quality: Provide all controls from one manufacturer, except as otherwise specified. Acceptable Manufacturers will be considered to be Trane, ABI, Carrier, Johnson Controls or equal. All materials and equipment used for the DDC system shall be standard components manufactured for this system and shall not be custom designed especially for this project.
- C. Workmanship Quality: Install a complete control system, with competent mechanics and electricians regularly employed by the Control Contractor.
  - 1. Supervise installation of control valves, control dampers and thermometer wells to be installed in pipes and ducts by other sections.
- D. Tests and Inspections: Provide tests and inspections as required to prove to the satisfaction of the Owner and Owner's representative that the controls perform as specified.

1.5 SUBMITTALS

- A. Procedures: Provide Technical Information Brochures and Shop Drawings in accordance with Section 230100.
- B. System Specifications: Submit manufacturer's data on all integrated components to the Owner for approval, including wiring diagrams and descriptions of the location and sizes of all temperature control panels and DDC panels. Control diagrams shall include:
  - 1. Detailed sequences of operation.
  - 2. Detailed descriptions of points of interconnection to the mechanical equipment.
  - 3. Complete lists of all control devices being used, cross-referenced to the control diagrams, indicating manufacturer's model number, quantity used, and calibration information.
  - 4. Point list of all input and output points, with descriptions of point type and service.
  - 5. Locations of all DDC system equipment, a detailed description of the DDC system configuration and descriptions of all software packages required.

- C. Product Data: Submit manufacturer's published literature for all control equipment, including all devices, thermostats, control valves, control dampers, controllers, DDC system panels, sensors, transducers, modems, relays and other specified equipment.
- D. Maintenance Data and Operating Instructions: Upon completion of the installation, submit to the Owner for approval, 3 sets of control manufacturer's published Operating and Maintenance data catalogs.
  - 1. After the installation is complete and has been accepted by the Owner, provide one eight-hour periods of instruction on the DDC control system, to be scheduled at the convenience of the Owner's personnel. Instruction on the control system shall include all operating procedures, control system configuration, calibration and adjustment procedures, routine maintenance procedures and DDC control algorithms.
  - 2. After completing the installation, furnish to the Owner for approval, three sets of "as built" control diagrams indicating all field changes to the control system during installation, test and adjustment of the controls.

#### 1.6 COORDINATION

- A. Coordinate the work of this Section with other trades for the related work to complete the automatic temperature control system. Furnish to other trades all information, data, installation details, diagrams and instructions for their performance.
- B. Carefully check space requirements with other trades to insure that all materials can be installed in the spaces allocated.
- C. Transmit all information required for work to be provided under other Sections in ample time for installation.
- D. Wherever work specified under this Section interconnects with work under other sections, coordinate work to insure proper installation of all necessary connections and equipment.
- E. Furnish and set all sleeves for passage of electric conduit and piping through masonry and concrete walls and floors as required to protect piping and wiring passing through building surfaces.
- F. Coordinate, protect and schedule work of this Section with other trades in accord with the construction sequence.

#### 1.7 WIRING AND CONDUIT

- A. Provide all conduit, wire, junction boxes and other electrical equipment as required for a complete control system.

- B. All electrical materials and equipment shall comply with the requirements of Division 26.

## 1.8 TAGS, CHARTS AND IDENTIFICATION

- A. Tag automatic control valves, dampers and controlled devices in an approved manner.
- B. Provide screw-fastened engraved phenolic nameplates with 1/4-inch high white lettering on black background, clearly indicating the function, designation or equipment controlled, for panels and all control items listed on the control diagrams.
- C. Provide full-size as-built shop drawings framed and under glass or laminated and wall-mounted at each control panel location or mechanical system.

## 1.9 GUARANTEE

- A. In addition to the requirements of Division-01 and Section 230100, the control system herein specified, including all DDC hardware and software components, shall be free from defects in workmanship and material under normal use and service for a period of no less than twelve months commencing at the time of final acceptance of the facility by the Owner. After completion of the installation the Controls Contractor shall adjust all thermostats, control valves, motors and other equipment provided under his contract. If within the warranty period, any of the equipment herein described is proved to be defective in workmanship or materials, it shall be replaced or repaired free of charge.

## PART 2 - PRODUCTS

### 2.1 MATERIALS AND EQUIPMENT FOR TEMPERATURE CONTROL

- A. Electric Controls:
  - 1. Room Temperature Sensors: Provide fully proportioning room Temperature Sensor with a scale range of 55 to 85 degrees F. Each temperature sensor shall be equipped with timed after hours override control.
  - 2. Low Temperature Detector: Provide a freeze protection thermostat upstream of each cooling coil on units with outside air to stop the fan on low temperature. The thermostat shall have a SPST switch with 35 to 45°F range with automatic reset and 8°F differential. The thermostat shall switch whenever any one foot or more of the sensing element is below the set point.
  - 3. Relays, Switches and Miscellaneous Electrical Control Devices: Provide any relays, switches or auxiliary control devices as required to provide a complete

control system as detailed herein and in the plans and as described by the sequence of operation.

B. Controlled Devices:

1. Automatic Control Valves: Furnish automatic control valves to Section 15650 for installation in the piping system.
  - a. Three-Way Valves: Provide fully proportioning three-way valves with modulating valve plug with equal percentage or characterized flow relationship and should be cast brass with screwed ends ( $\frac{1}{2}$ " to 2" valves) ANSI Class 125 or cast iron with flanged ends (2" through 4") ANSI Class 250 suitable for water service. Valves shall have stainless steel stems and replaceable composition discs.
2. Valve Actuators: Valve actuators for automatic valves shall be capable of positioning the valves smoothly and accurately and closing the valves against the differential pressures involved. Provide pilot positioners for all valves larger than  $\frac{3}{4}$ " for positive positioning and sequencing. Pilot positioners shall have field adjustable starting point and span adjustments. Provide stem position indicators for all valves.
3. Control Dampers: Provide all automatic control dampers for installation under Section 233314.
  - a. Provide dampers of low leakage, parallel blade type. Blades to be minimum 16 gauge galvanized steel of single unit design or 22 gauge galvanized sheet steel of double unit construction. Damper blades shall be 6 inch wide and a maximum length of 60 inches in length with square blade pins of zinc-plated steel. Frames shall be 13 gauge galvanized sheet metal with non-ferrous sleeve-type bearings. Dampers shall have solid stops with edge seals so that blade edges shall interlock with neoprene seals. Leakage shall not exceed 1% of full flow with the damper closed against 4" W.G. static pressure.
  - b. Set multiple sections of all automatic dampers in galvanized steel frame grid furnished as part of the damper and provide operation through a common jackshaft the full width of the damper.
4. Damper Operators: Operators shall be quiet in operation and have ample power to overcome friction of linkage and air pressure to operate dampers smoothly for velocities up to 2500 fpm.
  - a. Provide blade pin crankarm and adequate linkage between operator and damper capable of providing a normally closed or normally open damper position and operating the damper over a 90° stroke.
  - b. Damper operators shall have external adjustable stops to limit the stroke in either direction.
  - c. Damper operators for combinations Fire and Smoke Dampers shall be furnished with the dampers by Section 233314.

C. Temperature Control Panels: Provide U.L. listed temperature control panels of the latest design, for factory-mounting of all switches, relays, terminal blocks and any other panel-mounted equipment required for a completely functional temperature control system. The control panels shall have a cabinet door supported by a piano type hinge and a master key-locking latch. The panel shall be made of steel or extruded aluminum, with proper bracing for rigid wall or floor mounting.

1. Mark each control device on the panel with engraved nameplates describing its function and cross-referencing it to the control diagrams.

## 2.2 DIRECT DIGITAL CONTROL (DDC)

A. The Direct Digital Control (DDC) System specified herein shall be able, without additional equipment, to perform all of the automatic temperature control and energy management functions as required in this specification. Direct Digital Control shall be defined as a control technique through which the process variable is continuously monitored by a digital computer which accomplishes loop control by calculating a control solution with a control algorithm for output to a control device.

B. The DDC system shall independently control the building's HVAC equipment to maintain a comfortable environment in an energy efficient manner. The building operator shall communicate with the system and be able to control the sequence of operation within the building.

C. System Architecture: The DDC system shall consist of a network of independent, stand-alone control units (SCU). Each stand-alone control unit shall be capable of performing all specified control functions in a completely independent manner. Additionally, SCU's shall be capable of being networked for single point programming and for the sharing of point information and control instructions between panels. All operator communication with the system shall be via an existing operator terminal at a remote location. It shall be possible for each SCU to have a dedicated local display or for the network of SCU's to share the single remote operator terminal.

D. Stand-alone Control Unit (SCU):

1. Each SCU shall be capable of full operation either as a completely independent unit or as a part of the building-wide DDC control system. All units shall contain the necessary equipment for direct interface to the sensors and actuators connected to it.
2. Control strategies shall be owner definable at each control unit, and for all control units in the system from the remote operator terminal. Each control unit shall provide the ability to support its own operator terminal if so desired.
3. Each stand-alone control unit shall include its own microcomputer controller, power supply, input/output modules, termination modules, and battery. The

battery shall be self-charging and be capable of supporting all memory within the control unit if the commercial power to the unit is interrupted or lost for a minimum of eight (8) hours.

4. The stand-alone control unit shall be listed by Underwriters Laboratories (UL) against fire and shock hazard as a signal system appliance unit.
- E. Sensors/Input Signals: Each stand-alone control unit shall be capable of direct interface to a variety of industry standard sensors and input devices. It shall be possible for each stand-alone control unit to monitor the following types of inputs:
- Analog inputs
    - 4-20mA    - thermistors
    - 0-10 vDC   - 3-15 psi
  - Digital inputs
    - dry contact closure
    - pulse accumulator
- F. Actuators/Output Signals: The stand-alone control unit shall directly control electric actuators and control devices. Each control unit shall be capable of providing the following control outputs:
- Digital outputs (contact closure)
    - motor starters, sizes 1 to 4
  - Analog outputs
    - 4-20 mA
    - 0-16 vDC
- G. Building Control Functions: Each Stand-alone Control Unit within the DDC System shall perform both temperature control functions and energy management routines as defined by the operator.
1. All temperature control functions shall be executed within the stand-alone control unit. Loop control shall be executed via direct digital control algorithms. The user shall be able to customize control strategies and sequences of control, and shall be able to define appropriate control loop algorithms and choose the optimum loop parameters for loop control. Control loops shall support any of the following control modes:
    - Two-position (on-off, slow-fast, etc.)
    - Proportional (P)
    - Proportional plus integral (PI)
    - Proportional, integral, plus derivative (PID)

2. It shall be possible to fully create, modify or remove control algorithms within a specific stand-alone control unit while it is operating and performing other control functions. Each control loop shall be fully user definable in terms of:
  - Sensors/actuators that are part of the control strategy.
  - Control mode.
  - Gain.
  - Control action.
  - Sampling time.
3. Provide stand-alone control units that are able to share point information such that control sequences or control loops executed at one control unit may receive input signals from sensors connected to other stand-alone control units within the network. If the network communication link fails or the other stand-alone control unit malfunctions, the control loop shall continue to function using the last value received from the stand-alone control units.
4. Each stand-alone control unit shall be capable of performing the following energy management routines as a minimum:
  - Time of day scheduling.
  - Start/stop time optimization.
  - Supply air reset.
  - Outdoor air reset.
  - Event initiated programs.
5. The owner shall be able to create customized control strategies based upon arithmetic, Boolean or time delay logic. The arithmetic functions shall permit simple relationships between variables (i.e. +,-,x) as well as more complex relationships (i.e. square root, exponential).
6. The system shall permit the generation of job-specific control strategies that can be activated in any of the following ways:
  - Continuously.
  - At a particular time-of-day.
  - On a pre-defined date.
  - When a specific measured or controlled variable reads a selected value or state.
  - When a piece of equipment has run for a certain period of time.
7. Upon a loss of commercial power to any stand-alone control unit, the other units within the network shall not be affected, and the loss of operation of that unit shall be reported at the remote operator's terminal. All control strategies and energy management routines defined for the stand-alone control unit shall be retained during a power failure via the battery with the unit for a minimum of eight (8) hours. Upon resumption of commercial power, the SCU shall resume full operation without operator intervention. The unit shall also automatically reset its



clock such that proper operation of timed sequences is possible without the need for manual reset of the clock.

8. Should a loss of power exceed memory back-up, the building operator shall be able to manually restore all system programs off of cassette tapes.

#### H. Operator Interface:

1. The DDC system shall permit full operator communication including; obtaining information about the performance of his system; allowing the operator to change the system operation; and diagnosing system malfunctions. Operator communication shall be through the use of any one of the following operator terminals:
  - hand-held terminal (local)
  - printer (local or remote)
  - black and white CRT (remote)
2. It shall be possible to have one operator's terminal at each stand-alone control unit, or to have a single operator's device which can be connected to any panel in the network. The DDC system shall permit complete operation of any stand-alone control unit within the network, from any operator terminal within the system.

#### I. User Programmability:

1. All temperature control strategies and energy management routines shall be definable by the operator through an operator's terminal. It shall be possible for the operator to modify system functions independently after receiving the training from the control contractor as specified in paragraph 1.04. The system shall be provided complete with all equipment and documentation necessary to allow a trained operator to independently perform the functions listed below:
  - read the value of a measured variable (i.e. temperature).
  - start or stop equipment.
  - monitor the status of equipment being controlled.
  - read the set point of a control loop.
  - determine the control strategies that have been defined for a specific piece of equipment.
  - generate displays of control strategies.
  - add/delete control loops to the system.
  - add/delete points to the system.
  - create, modify or delete control strategies.
  - assign sensors and/or actuators to a control strategy.
  - tune control loops through the adjustment of control loop parameters.
  - enable or disable control strategies.
  - generate hardcopy records of control strategies on a printer.
  - select points to be alarmable and define the alarm state(s).

J. Expansion Capability:

1. The building control system, as installed, shall permit an easy upgrade to greater functionality and performance through the addition of a central host computer and the necessary operator terminals. The network shall be fully compatible with this additional central computer.
2. An upgrade to a system with a central computer will allow the following functions:
  - support of dynamic color graphic displays
  - maintenance management
  - wider range of English language reports
  - sophisticated trend analysis
3. If the DDC system is upgraded to a system with a central computer it shall not be necessary for the operator to reenter building data or redefine the control strategies already resident within the stand-alone control units.

K. Self Diagnostics and Alarm Reporting:

1. Each stand-alone control unit shall contain self diagnostics that continuously monitor the proper operation of the unit. A malfunction of the unit will be reported, and will inform the operator of the nature of the malfunction, and the control unit affected. It shall be possible to annunciate malfunctions as well as other control unit alarms at the remote terminal.
2. The system shall also allow on-line diagnosis via telephone modem from a remote location.

L. Operator's Terminal:

1. Furnish one personal computer, minimum Pentium III 500 MHZ, as operator's terminal complete with color monitor, printer and other accessories to the Owner for access and controlling the DDC network.
2. The Operator's terminal shall be able to perform the following functions:
  - Display all point status report.
  - Display alarm report.
  - Add, change or delete points.
  - Change setpoints.
  - Add, change or delete custom control sequences.
  - Command points to a specific state.System shall be equipped with color graphics to indicate building floor plans and equipment locations and operation on real time basis. System shall be provided with modem or communications hardware required for remote system monitoring and adjustment.

## 2.3 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

JOHNSON CONTROLS BRANCH  
KMC  
TRANE

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordinate the work of this section with the work of all applicable sections of Division-23 and -26, and all other applicable Divisions.
- B. Install all materials and products furnished in this section in a workmanlike manner with skilled mechanics and electricians regularly employed in the installation of commercial automatic temperature control systems.

### 3.2 ELECTRIC WIRING

- A. Provide installation of all control wiring, terminations, and required conduit, fittings and related wiring accessories in accordance with the requirements of Division-26.
- B. Provide and install all interlock wiring between electrical equipment and control components required for control interlocking as specified in the sequence of operation and indicated in the control diagrams.

### 3.3 CALIBRATION AND ADJUSTMENT

- A. Provide calibration and adjustment of the entire control system after the entire installation is complete. Coordinate the calibration of the static pressure controllers with the Test and Balance to ensure proper set points and sensitivities. Place the control system in final operating condition subject to Owner approval.
- B. Provide tests as required by the Owner and/or the Owner's representative to show that the control system is operating as specified.

### 3.4 AUTOMATIC TEMPERATURE CONTROL SEQUENCES

- A. General: The following sequences of operation are intended to convey the normal operating sequence of each particular system when in the automatic control mode as controlled by the DDC system.
- E. Fans:

1. All fans scheduled with interlocks and EMS controls operate during occupied mode. All fans shall stop during unoccupied mode.
  2. Refer to plans for additional control strategies.
- F. Outside Air Dampers:
1. All outside air intakes shall be provided with motorized damper. Dampers shall be open during occupied mode. All dampers shall be closed during unoccupied mode.

END OF SECTION

## SECTION 230925 - VARIABLE FREQUENCY DRIVE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 WORK INCLUDED

- A. Variable Frequency Drives: Provide and install Variable Torque Variable Frequency Drives (VFD) for variable speed where indicated on the plans, suitable for controlling NEMA Design B motors on continuous duty in variable volume applications. The VFD shall be listed by Underwriter's Laboratories, E.T.L., or CSA as approved by the Engineer and shall comply with the latest standards of ANSI, IEEE and the NEC.
- B. General: The Variable Frequency Drive shall be capable of converting 460V + 10%-5%, three phase, 60 Hz + 2 Hz utility input power to variable frequency, three phase AC power for variable torque motor control continuously from 10% to 110% of base speed. Output shall have voltage to frequency relationship for a 460V, three phase motor. A transformer shall not be required for the input or output to operate on 460V. All general options and modifications shall mount within the VFD enclosure.
- C. Basis of Design: Basis of this design is Graham Model 1576 for purposes of conveying the minimum acceptable level of performance and control interfaces. Variable Frequency Drives manufactured by Square D Class 8804 OmegaPak VT, Allen-Bradley Bulletin 133, or Parametrics will be considered acceptable if all provisions of this specification can be met. Other manufacturers who can comply with all provisions of this specification shall be required to submit technical information brochures for pre-bid approval, in accordance with the provisions of Section 230100.
- D. Submittals: Provide submittals in accordance with Paragraph titled "Power Factor" of this Section and with Section 230100. In addition, furnish the following technical information for Engineer's review and approval:
  - 1. Complete technical information on the Variable Frequency Drive and all specified options, indicating all cabinet dimensions and space requirements for the VFD, including bypass contactors and line reactors.
  - 2. Complete efficiency versus load and speed data for all VFD ratings showing that the VFD with necessary isolation transformers or line reactors is capable of providing full motor nameplate rated horsepower.
- E. Power Factor: The power factor shall be maintained at 0.95 throughout the speed range of the drive.

### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the drawings and specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Direct Digital Control System and Expansion.
  - 2. Performance Verification.
  - 3. Air Handling Units.
  - 4. Fans, Utility.
  - 5. Electrical sections.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. The VFD unit shall be totally enclosed in a free-standing NEMA 1 enclosure for floor mounting, and shall be capable of dissipating any heat generated by the VFD circuitry. All unit-mounted controls shall be mounted on the face of the VFD enclosure. VFD shall be capable of operating in an ambient temperature of 0-40°C.
- B. The VFD shall incorporate an input molded case circuit breaker sized to provide a short circuit interrupting capacity of 30,000 symmetrical amps. The input breaker shall be mechanically interlocked with the power unit enclosure door.

### 2.2 UNIT REQUIREMENTS

- A. Control Interface: The following control interfaces shall be provided at a terminal strip in the VFD as a minimum to assure control system integrity:
- B. Speed Control Input: A 4-20mA signal proportional to speed shall be furnished under Section 230923 to the Fan System for directly controlling the speed of the VFD's when in automatic mode in response to static pressure.
- C. Start/Stop Control: The VFD shall be capable of being started and stopped remotely by a maintained-contact start/stop relay furnished in this section and other remote relay contacts.
- D. Control Interlock: The VFD shall provide an auxiliary control interlock output of 115 VAC whenever the VFD is enabled, to provide interlocking with the control system. The VFD shall be furnished with two sets of N.O. contacts for control interlocking.

The VFD shall be provided with a 115 VAC control transformer so that no external 115 VAC power source is required.

- E. Speed Signal Reference: The VFD shall furnish a 0-5 VDC or 4-20mA signal directly proportional to the output frequency of the VFD, for remote monitoring of the VFD speed at the building automation system under Section 230923.
- F. Hand-Off-Auto Switch: The VFD shall be furnished with a door-mounted Hand-Off-Auto switch to allow switching of the speed control signal from the "Automatic" signal to a manually selected speed potentiometer on the VFD when in the "Hand" position. The VFD shall be disabled when in the "Off" position.
- G. VFD Trip Contacts: The VFD shall be furnished with a set of N.O. contacts for remote annunciation to the building automation system under Section 230923.
- H. Speed Potentiometer: A manually selected speed potentiometer shall be door-mounted to manually select the speed when the H-O-A switch is in "Hand" position.
- I. Speed Meter: The VFD shall be furnished with a door-mounted speed meter (0-100%) to indicate the frequency of the VFD.
- J. Manual Bypass with Magnetic Contactors: A door-mounted manual bypass switch shall be provided as a means of bypassing the VFD circuitry for emergency operation. In "normal" mode, the motor is controlled by the VFD. In "bypass" mode the motor is directly connected to the building power. Motor protection thermal overload shall be provided in "bypass" or "normal mode".
- K. Manual bypass shall provide all the circuitry necessary to safely transfer the motor from the VFD to the power line, or from the line to the controller, while the motor is at zero speed. This option shall be located in the VFD cabinet. This enclosure section shall house all devices which must be energized at either 460 VAC or 115 VAC while operating in the bypass mode, for personnel safety.
  - 1. Two motor contactors, electrically interlocked, shall be utilized. One contactor is to be between the VFD output and the motor, controlled by the VFD regulator; and the other one is to be between the bypass power line and the motor, providing across-the-line starting. Motor protection is to be provided in both the "normal" mode and the "bypass" mode by a motor overload relay. The 115 VAC relay control logic, allowing common start-stop commands in the "controller" mode and the "bypass" mode shall also be included within this enclosure.
  - 2. The bypass section door shall include a "VFD-Off-Bypass" selector switch and "VFD Mode" indicator light and a "Bypass Mode" indicator light. Terminals shall be provided for remote light indication of mode selection.
  - 3. The bypass option shall include a door interlocked, main power input disconnect circuit breaker, providing positive shutdown of all input power to both the bypass circuitry and the VFD.

4. The bypass circuit shall include a second door interlocked input disconnect circuit breaker installed in the VFD. This disconnect shall provide the ability to safely troubleshoot and test the controller, both energized and de-energized, while operating in the "bypass" mode.
  5. Manual bypass with magnetic contactors shall be factory installed.
- L. Variable Frequency Drive Controller: The VFD controller shall be completely solid state PWM or variable voltage source design. The VFD shall provide the following standard features:
1. Minimum and Maximum Speed Potentiometers shall be furnished to select a minimum (10-50%) and maximum (50-100%) output frequency.
  2. Linear acceleration and deceleration functions adjustable from 4-20 seconds shall be furnished.
  3. Safety features shall be provided to protect the VFD internal circuitry and motor, including but not limited to the following:
    - a. Current limit feature to limit output current from 50-110% of that of the inverter rating. The current limit shall be designed to function automatically to prevent overcurrent trip due to momentary overload conditions, without shutdown.
    - b. Instantaneous overcurrent trip to safely limit the output current in under 50 micro seconds due to phase to phase short circuits or severe overload conditions, without damage to input fuses or thyristors.
    - c. Under- and over-voltage trip for non-momentary power or phase loss. Automatic restart shall occur on undervoltage condition.
    - d. Drive diagnostic fault indicator for continuous indication of drive status.
    - e. Isolated current and voltage signals from logic circuitry.
    - f. Fast-acting current limiting input fuses.
    - g. In the event of a sustained or momentary power loss, the control shall shut down safely without component failure. Upon return of power, the system shall automatically return to normal operation.
    - h. In the event of phase to phase short circuit on the output due to motor failure or power failure the control shall shut down safely without component failure.
    - i. Overtemperature safety shall be provided to shut down the VFD if the internal temperature becomes excessively high.



- j. Solid-state ground-fault protection and indication shall be provided with the VFD.
- k. VFD shall not require external 120 volt control circuit to perform any of the functions listed herein. Any control power required shall be provided internally from the VFD.
- l. Motor Thermal Overload Protection shall be provided with door-mounted reset button and integral adjustments for the exact motor full load amps. Motor thermal overload relay shall be mounted inside the VFD cabinet.
- M. Line Noise: The Variable Frequency Drive shall be furnished with Class H dry type isolation transformers, Class H insulation line reactors and other line noise filtering devices as required to prevent line noise from being transmitted into the AC power system. The line noise shall be no greater than 3% Harmonic Distortion and no more than a 16,400 volt-microsecond commutation notch area, in accordance with IEEE Standard 519-1981 for Special Applications. Line noise testing shall be accomplished at the jobsite with a spectrum analyzer to determine line noise levels. Line reactors or filters should be considered in sizing the VFD units to ensure that the overall power conversion efficiency does not reduce the fan capacity below that listed in the fan schedule.
- N. Efficiency Rating: Complete efficiency versus load and speed data for all VFD ratings shall be submitted and shall be no less than 95% at 100% speed and 87% at 60% speed.
- O. Factory Testing and Warranty: Each VFD shall be factory tested to insure reliability. Testing shall include component thermal cycling, logic system simulation tests and full load operation tests. The VFD shall be heat tested with power on for 50 hours at 50oC. VFD shall be furnished with manufacturer's written certification of tests conducted and shall be warranted for one full year (from date of startup) against component failure.
- P. Diagnostic Features: The VFD shall contain diagnostics to allow on-site troubleshooting of fault conditions through built-in diagnostic indicators or through a diagnostic tester. One diagnostic tester must be included with the VFD package, to provide a functional test of each regulator card through a prewired diagnostic test port.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Start-up Service: Provide the services of a factory-trained service technician during startup to ensure that the VFD units have been installed and wired correctly and that the factory-recommended startup procedures are followed for each of the VFD units installed.

- B. Instructional Period: Provide one 8-hour instructional period to the Owner's maintenance personnel, scheduled at the Owner's convenience during the Warranty period, to provide instruction on the design, operation and maintenance of the Variable Frequency Drives.

END OF SECTION

## SECTION 232113 - PIPING SYSTEMS: HVAC, WATER

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide systems as indicated and include all offsets, fittings, sleeves and similar items required (but not indicated due to drawing scale) for complete and operable systems.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of the Division-23 and to all other applicable portions of the drawings and specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Valves, cocks and specialties.
  - 2. Thermometers, gauges and flow meters.
  - 3. Insulation.
  - 4. Connected equipment.

#### 1.4 SHOP DRAWINGS

- A. Refer to the Section entitled "General Mechanical Provisions".

#### 1.5 INDUSTRY STANDARDS

- A. Where compliance with an industry, society or association standard is specified or indicated, certification of such compliance shall be submitted with shop drawings.

#### 1.6 PRESSURE AND TEMPERATURE RATINGS

- A. Temperature: Unless otherwise specified, ratings shall be at 150°F for the chilled and condenser water systems and 200°F for the hot water system for all components specified herein.
- B. Pressure: Unless otherwise specified, all components must be of pressure class and rating to be recommended for operation at the maximum allowable non-shock pressure of 200 psig.

## 1.7 FLUIDS

A. This section covers the following fluids:

1. Chilled water.
2. Hot water.

## PART 2 - PRODUCTS

### 2.1 GENERAL

A. Application: Piping systems shall be of the materials indicated.

B. Quality and Weight: Materials shall comply with requirements and specifications of the appropriate standards of the American Society for Testing and Materials.

### 2.2 STEEL PIPE AND FITTINGS

A. Pipe: Black steel, seamless or electric weld for pipe sizes two (2) inches and above, continuous weld below two (2) inches, conforming to ASTM Std. Spec. A-53 or A-120. Schedule 40 to 10"; 0.375" wall thickness for 12" and greater.

B. Fittings:

1. General: Be wrought steel socket welded or threaded, or wrought steel butt welded, rated to match the schedule of the connected pipe.
2. Screwed Fittings: Malleable iron, ASTM A-47. Unions shall be 250 lb. (maximum) ground joint type. All couplings, regardless of size shall be taper tapped; i.e., couplings 2 inches and smaller shipped with pipe are not acceptable for use in the piping system.
3. Welded Fittings: Forged, seamless, black steel, long radius, conforming to ASTM Std. Spec. A-234. Weldolet fittings may be used in lieu of forged tees where branch connections are not larger than three-quarters the size of main pipe. Use groove or ridge type welding rings on all piping over 4-inch diameter. Mitre elbows, tees and reducers are prohibited.

### 2.3 COPPER PIPE AND FITTINGS

A. General: Comply with ASTM A-88. Copper is allowed for pipe sizes only up to and including 4-inch diameter.

B. Pipe and fittings (½-inch OD and less): Type L soft drawn tubing with flare fittings.

C. Pipe and Fittings (up to 4-inch diameter): Type L, hard drawn, ASTM-B88 with wrought or cast brass solder joint fittings.

### 2.4 UNIONS, FLANGES AND DIELECTRIC INSULATORS

- A. Unions: Use ground joint unions on piping 1-1/2" and smaller, and flanged unions on sizes 2" and larger. Use malleable iron on steel piping black or galvanized as specified for piping. Unions in copper piping shall be brass.
- B. Flanges: Forged carbon steel, welding neck type conforming to ASTM Std. Spec. A-181 Grade 1. Flanges shall have raised face and gaskets conforming to ANSI B16.5.
- C. Dielectric Isolators:
  - 1. Dielectric Unions: Are to be used at all junctions of copper pipe and steel equipment. Use flanged type insulated unions in piping 1-1/2" and larger with screw or solder joint connections to suit pipe and equipment. Epco, Capitol Manufacturing and Supply Co., Patrol Valve Co., or approved equal.
  - 2. Dielectric Flanges: For pipe sizes two and one-half inches and over; Plico Products, flanged insulation sets with; phenolic retainer, nitrile rubber seal element, polyethylene sleeves and double washer sets.

## 2.5 PIPE NIPPLES

- A. Provide nipples of same material and weight as pipe used. Provide extra strong nipples when length of unthreaded part of standard weight nipple is less than 1-1/2".

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Routing and Placement: Piping shall be run without traps or pockets and pitched 1" in 40' in the direction of flow. Interior piping shall be run parallel to the walls and ceilings in a neat manner and shall be offset as required to avoid interferences with structural or architectural features and other work. Exterior piping (above and below grade) shall essentially be routed and located as indicated on the drawings; however, actual placement shall be verified by confirming exact location of structures and other utilities in the field and by careful layout prior to execution of the work. Drawings are generally diagrammatic and do not show every bend, off-set, elbow or other fitting required in the piping for installation in the indicated location. Coordinate installation so that no conflicts or interferences are created with other piping, equipment or other work.
- B. Run all lines parallel or perpendicular to building lines and with a minimum of joints and fittings. Avoid diagonal runs where possible.
- C. Insulated Piping: For piping requiring insulation, install piping with sufficient clearances to permit proper application of the insulation.

### 3.2 APPLICATIONS OF PIPING SYSTEMS

- A. General: Piping systems may be installed as steel or copper systems of the materials specified. These systems may be installed as combinations of steel and

copper providing the appropriate dielectric isolators, methods of joining, compliance with maximum and minimum allowed sizes, and other requirements are provided.

### 3.3 EXPANSION AND CONTRACTION

- A. Piping shall be installed with provisions for expansion both horizontally and vertically in all long runs including runouts from risers. Essentially the provisions shall take the form of expansion loops or expansion elbows, as indicated on the drawings; however, in certain portions, where indicated, these provisions may take the form of expansion connectors as specified in other sections.

### 3.4 JOINTS AND CONNECTIONS

#### A. General:

- 1. Correctly align all pipe before joints are made.
- 2. Joints in copper piping shall be made with 95-5 solder and flux.
- 3. Joints and connections shall be made permanently air, gas and water tight.

- B. Welded Joints: All pipe 2-1/2" and larger shall be welded. Cut pipe square using pipe cutting tool and carefully ream pipe to remove all burrs. Bevel ends of pipe and, after carefully aligning and setting of proper weld gap, tack weld to secure pipe and fittings in true alignment. All weld shall be of sound metal with tack welds removed in advance of finish weld.

- C. Welder Certification: All welding shall be performed by welders certified in accordance with ANSI B31.1 with test conducted by the National Certified Pipe Welding Bureau or by other approved testing laboratory. Copy of certification shall be available at job sites. Welders shall show certification certificates to inspector at or prior to time welder is assigned to job. If work of welder is not satisfactory to the inspector, recertification will be required.

- D. Welding Rings: Provide welding rings for all butt welded joints.

- E. Screwed Joints: Shall be used on steel pipe two (2) inches and smaller except where flanged connections to equipment or valves are required. Cut pipe square using pipe cutting tool and carefully ream pipe to remove all burrs. Cut a complete thread, using sharp dies properly set and centered, while applying oil graphite cutting lubricant. Use non-hardening compound or tape on male threads only at each joint and tighten joint to leave not more than 3 threads exposed. Provide American Standard Thread screwed joints.

- F. Copper Tube: Ream all pipe after cutting squarely, clean outside of tube ends and inside of fittings and tin end to be soldered. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

- G. Dissimilar Metals: Where incompatible piping system materials come in contact (except for the use of valves), isolate the two materials with dielectric isolators.

### 3.5 EQUIPMENT CONNECTIONS

- A. General: Make connections between any piece of equipment and any piping system in this Section of the Specifications by means of unions, flange joints or other fittings which permit equipment to be disconnected and removed for maintenance. Connections to equipment shall be made in accordance with details on the drawings and the equipment manufacturer's installation instructions. Final connections to equipment shall be made with unions for pipe sizes two (2) inches and under and as otherwise noted below for pipe sizes over two inches.
- B. Chillers: Connections to condensers and evaporators shall be made using mechanical pipe couplings, as specified in another section.
- C. Pumps, Valves, Strainers and Other Equipment: Connections shall be made using flanges and bolt and gasket sets to suit the individual pieces of equipment and insure ease of service access.

### 3.6 BRANCH AND RISER ISOLATION

- A. Valves: Provide valves to isolate each riser and branch line.

### 3.7 PIPE SIZE REDUCTIONS AND ENLARGEMENTS

- A. Screwed bushings are prohibited, except where available space prevents use of reducing couplings. Pipe reductions on horizontal piping shall be made with eccentric reducers. Top of piping shall be flat for venting.

### 3.8 VALVES

- A. General: All valves, balancing cocks and similar items shall be installed in an easily accessible location. Provide access panels for all concealed valves. Where butterfly valves are used, they shall be installed between properly spaced flanges, then run to the full open position before mounting bolts are tightened in order to insure a balanced pressure on the seat and prevent distortion.
- B. Install valves or cocks in supply and return lines to each piece of equipment on piping main side of union connections.
- C. Install valves in horizontal piping with the valve stem in the vertical upright position.
- D. Install valves to provide adequate clearance to permit easy operation of the valve hand wheel and permit servicing of the valve packing.

### 3.9 AIR VENTS AND DRAINS

- A. Vents and drains shall be provided where shown on the drawings, and at all high and low points, respectively, in the system. Provide gate valves (3/4") with hose thread connector (adapter) at each vent and drain point.

### 3.10 INSTRUMENTATION AND SPECIALTY ITEMS

- A. Thermometers, gauges, gauge cocks, gauge valves, instrument wells, flow stations, flow switches, control valves and similar items which may be specified in other Sections shall be installed complete, including the provision of standard pipe fittings as may be required, as work of this Section. Installation of these items shall be in strict accordance with the manufacturer's installation instructions.

### 3.11 FLOW INDICATING AND/OR BALANCING VALVES OR METERS

- A. Install flow indicating balancing valves where shown on drawings. The locations shown on drawings or otherwise indicated are diagrammatic in nature and are intended basically to show the requirement for flow measurement and shut-off relative to a specific piece of equipment or portion of the system and not in the exact physical location of the device. The exact physical location shall be determined using field measurements relating to upstream and downstream clearances. Install in accordance with manufacturer's recommendations including increases or decreases in pipe size at points of installation together with minimum recommended lengths of straight run pipe before and after points of installation. Balancing shall be done as work of the section describing test and balance.

### 3.12 PRESSURE RELIEF VALVES

- A. Install pressure relief valves where specified or indicated on the drawings. Pipe to spill over floor drain or service sink.

### 3.13 TESTS

- A. Prior to insulating and concealing the pipe, apply a water pressure test to all parts of the systems before equipment is connected. Use a hydrostatic pressure of not less than 100 psig or 150% of system operating pressure, test system for a period not less than four hours. There shall be no leaks at any point in the system at this pressure.
- B. Leave concealed work uncovered until required tests have been completed, but if necessary, make tests on portions of the work and those portions of the work may be concealed after being inspected and approved. Make repairs of defects that are discovered as a result of inspection or tests with new materials. Caulking of screwed joints, cracks or holes will not be accepted. Repeat tests after defects have been eliminated.
- C. Complete all field testing prior to insulation, wrapping and/or backfill.

### 3.14 FLUSHING AND CLEANING

- A. After final testing, thoroughly flush each piping system with clean water to remove debris. Disconnect all coils and heat exchangers from the system before flushing. Flush all coils and heat exchangers separately to assure that debris does not



become lodged in them. Provide temporary valves and drains as required to accomplish flushing.

- B. After flushing, thoroughly clean each piping system with appropriate cleanser to remove oil, grease, lacquer, etc. Thoroughly flush each system with clean water after cleaning.
- C. Also see section describing water treatment systems for HVAC Systems.

### 3.15 PROTECTION

- A. Paint all uninsulated piping underground except cast or ductile iron or PVC with two coats of asphaltic paint. (Manual wiping is not acceptable.)
- B. Wrap pipe that touches metal or is exposed to masonry with a layer of 6 mil polyethylene film or 15 lb. felt.
- C. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate. Remove pipe thread lubricants prior to applying paint.

END OF SECTION

## SECTION 232125 - PUMPS, HORIZONTAL BASE MOUNTED END SUCTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide single stage, end suction, vertically split case centrifugal pumps as specified herein and /or shown on the drawings.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications. Coordinate, where applicable, with variable speed drive systems.

#### 1.4 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Include data on: materials of construction dimensions; weights; curves; brake horsepower requirements; motor horsepower; drive couplings; efficiencies; coupling guards; and operating and maintenance instruction. Pump curves shall be clearly marked to show pump performance at scheduled points and, where pumps must operate in parallel, both single and parallel operating points. Where pumps are specified with variable speed drives, provide operating curves at fifty (50) rpm increments throughout the specified operating range.

#### 1.5 SELECTION AND CAPACITY

- A. Each scheduled pump has been selected near its point of maximum efficiency. Pumps which may be proposed which are other than those used as a design basis must be selected with the same considerations of efficiency, impeller diameter and other characteristics to be capable of providing the capacity intended.
- B. Pumps and motors shall be selected to provide a non-overloading assembly regardless of pressures and flow rates which may be actually encountered in the system.
- C. Impeller Selection: Selected to operate efficiently at the scheduled points and shall be neither the largest nor smallest impeller for the selected pump casting.

- D. Motor horsepower scheduled have been selected to be non-overloading at any point on the pump curve of the scheduled pump and this condition must hold true of any pump proposed for this service.

## 1.6 MANUFACTURER

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:

1. Allis Chalmers
2. Buffalo
3. Chicago
4. Taco
5. Peerless
6. Paco
7. Aurora
8. Bell & Gossett
9. Weinman
10. Mueller
11. Amtrol
12. Crane
13. Armstrong

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Pumps: Horizontal mount, vertically split case, single stage, end suction, centrifugal pumps of the quantity, size and capacity indicated.
- B. Casing: Split on the vertical axis. Close grained cast iron. Casing shall be designed for 175 psi working pressure and shall be hydrostatically tested at 150% of the maximum working pressure. Suction and discharge flanges shall be drilled to ANSI Standards.
- C. Impeller: Cast bronze. Keyed to the shaft and securely retained in an axial position by positive mechanical means.
- D. Drive: Motor's horsepower scheduled have been selected to be non-overloading at any point on the pump curve of the schedule pump. Pumps proposed must comply with this condition.

- E. Mechanical Seals: Designed for operation in 225°F liquid and mounted in one piece cast construction stuffing boxes. Stuffing boxes shall include provision to flush the seal faces.
- F. Bearings: Radial and thrust bearings shall be single row ball, grease lubricated, self-aligning type mounted in cast iron cartridges. Sized for 20,000 hours B-10 life which is 100,000 hours average life. Removable without disassembling the pump.
- G. Coupling Guard: Provide coupling guard for each pump.
- H. Base: Steel drip rim base for each pump unit. Pump and drive unit carefully aligned and bolted in place prior to factory shipment.
- I. Motors: Open drip proof with greaseable ball bearings. Motors installed outdoors, in unprotected areas, or subject to exposure to moisture shall be TEFC type. Where variable frequency drives are employed, or as otherwise directed, provide motor of high efficiency type; coordinate with variable frequency drives.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Install pumps where indicated, in accordance with manufacturer's published installation instructions, with recommended clearances provided for service and maintenance. Pump placement shall be essentially as shown on drawings; however, actual location shall be verified using field measurements and data relating to actual pumps and adjacent equipment as actually approved for installation on this project.

#### 3.2 PIPING AND ACCESSORIES

- A. Provide piping, accessories, hangers, supports, and anchors; valves; meters and gages; vibration isolation; and equipment supports; as indicated for complete installation.
- B. Provide all necessary unions and/or flanges on all appropriate items so that all items (strainer, flexible connection, suction diffuser, pump, balancing cock, check valve, etc.) between suction side gate valve and discharge side gate valve can be easily replaced and/or serviced without disturbing any other portions of the system.

END OF SECTION

## SECTION 232313 - REFRIGERANT PIPE, VALVES AND SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide refrigerant piping systems, complete in all respects, between the system components and connected equipment.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SHOP DRAWINGS

- A. Refer to the Section entitled "General Mechanical Provisions".

### PART 2 - PRODUCTS

#### 2.1 COPPER PIPE

- A. Refrigerant system piping shall be refrigerant grade, dehydrated and sealed, seamless, uniformly dead soft temper.

#### 2.2 FITTINGS

- A. Refrigerant grade, wrought copper, long radius, solder joint type.

#### 2.3 SOLDER

- A. Silver brazing alloy (Sil Fos) Fed. Spec. AA-S-56ld.

#### 2.4 FLUX

- A. Non-corrosive, specifically designed for silver brazing.

#### 2.5 ACCESS VALVES

- A. Schrader type designed for use with quick coupler hose fittings and provided with individual cap.

## PART 3 - EXECUTION

### 3.1 PIPE SIZES

- A. Refrigerant pipe sizes which may be shown on drawings are nominal. Provide sizes not less than sizes indicated and in compliance with size recommended by the manufacturer(s) at the connected equipment. Provide change in sizes if such change is in accord with manufacturer's recommendation and with Architect/Engineer's approval. Size piping to maintain minimum velocity of 500-fpm in horizontal lines and 1000 fpm in vertical risers for proper oil return; provide double suction risers and hot gas risers as may be necessary to accomplish this.

### 3.2 REFRIGERANT SPECIALTIES

- A. Refrigerant valves, driers, expansion valves, and similar items shall be provided with each system. Where refrigerant access valves are not furnished by the manufacturer, they shall be field installed to enable charging and checking the system.

### 3.3 JOINTS AND CONNECTIONS

- A. General: All joints and connections shall be made permanently refrigerant tight.
- B. Solder Joints: Cut tubing square using tubing cutters, with sharp cutting wheels, so as not to crimp the tubing ends. Remove all burrs using a pipe reamer and taking care not to flare the ends of the tube. Thoroughly clean the outside of the pipe and the inside of the fitting using a fine sand cloth. Apply non-corrosive paste flux to the cleaned surfaces immediately and apply silver solder and heat in accordance with manufacturer's instructions. Use care not to damage equipment or refrigerant specialty items when making up joints (protect from excessive heat).
- C. Scale Prevention: During brazing, keep pipe system full of inert gas to prevent scale formation.
- D. Mechanical Joints: Where the Contractor uses refrigerant tubing sets, follow the manufacturer's installation instructions explicitly, including the use of special tools, when making up the joints. Where precharged tubing and equipment is provided, do not cut into the system to install access valves.

### 3.4 HANGERS AND SUPPORTS

- A. Refer to other sections describing hangers and supports. Isolate copper tubing from contact with any dissimilar metals.

### 3.5 EVACUATION AND CHARGING

- A. When other than completely factory charged equipment and piping systems are used, they shall be evacuated and charged as follows: Charge the system with dry nitrogen and refrigerant and leak test all joints including factory piping within the

units. Repair all leaks by disassembling and remaking the joint. After all leaks are corrected, evacuate the system to an absolute pressure of 0.2" mercury. System shall hold this vacuum for two hours with no noticeable rise in pressure. After passing vacuum test, break vacuum twice using refrigerant and re-evacuate for a minimum of two hours each time. Charge the system in the manner and with the type and amount of refrigerant recommended by the manufacturer and in accordance with accepted refrigeration practice.

### 3.6 REFRIGERANT PIPING CONDUIT

- A. Install any refrigerant piping which is below slab or grade in Schedule 40 PVC piping. Size conduit as necessary to properly install piping. Provide long bend sweeps. Install so that conduit will drain and not trap water. Protect ends of conduit from entry by vermin, insects and water.

### 3.7 OTHER REQUIREMENTS

- A. Arrange piping generally as shown and such that service access is facilitated. Keep refrigerant lines as short and direct as possible with a minimum number of joints. Provide sleeves through floors, walls or ceilings, sized to permit installation of full-thickness insulation; seal air tight after installation of piping and insulation.
- B. Provide flexible piping arrangement in hot gas discharge line of compressor. Such arrangement shall consist of a piping loop or similar measure to prevent transmission of objectional vibration.
- C. Provide a removable core filter-drier in liquid line. In-line filter-driers are acceptable in individual circuits of less than 10-ton nominal capacity. Provide a full size valved bypass around this filter-drier. Provide shut-off valves to isolate the filter drier while flow is through the bypass and also a shutoff valve in the bypass so that filter-drier can be put into use.
- D. Provide a refrigerant charging connection in the liquid line upstream from the filter-drier.
- E. Provide a moisture indicating sight glass in the liquid line downstream from the filter-drier. Install in vertical line if possible and a sufficient distance downstream from any valve such that the resulting disturbance does not appear in the glass.
- F. Provide a filter-drier with isolating shut-off valves and with valved bypass only if compressor is not equipped with a suction line filter or screen.
- G. Keep piping free from traps unless otherwise indicated. Install vertical pipe plumb. Pitch horizontal piping only where slope is desirable.
- H. Provide shut-off valves at inlet and outlet to all condensers, receivers and evaporators to permit isolation for service. If possible, use angle valves to minimize pressure drop. Use angle valves in all cases at receivers. Use globe valves only when angle valves are impractical.

- I. Provide solenoid valves upright in horizontal lines only, unless their design allows installation in vertical pipe.
- J. Where compressor(s) do not have pump down control and the compressor(s) associated evaporator coil(s) do not have bottom suction header connections and the evaporator coil(s) are located above the compressor(s), then loop suction lines(s) to top level of coil to prevent liquid slugging.
- K. To prevent erratic operation of thermal expansion valve, provide a suction line trap next to evaporator coil suction outlet with expansion valve bulb located between coil and trap. Provide only in suction lines which are level leaving coil outlet or which rise on leaving coil outlet. Trap not required when evaporator coil outlet suction line drops to compressor or suction header immediately after expansion valve bulb.

END OF SECTION



SECTION 232500 –  
WATER TREATMENT SYSTEMS: CHILLED WATER AND CONDENSER WATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

1.2 SCOPE

- A. Scope: Provide complete water treatment systems for chilled water system and for condenser water system. Provide water treatment systems as indicated on the drawings and specified herein and provide all plant, materials, equipment and labor required to flush and clean the new piping systems prior to operation.

1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division-23 and to all other applicable portions of the Drawings and Specifications.
- B. The chillers shall not be operated until all work of this Section is complete and the initial treatment begun. Coordinate the installation of all piping system mounted equipment control with all trades involved to insure a timely and workmanlike installation.

1.4 SHOP DRAWINGS

- A. Include specific data on: all chemicals; controls, feeders, pumps; blow down valves and like items; as well as complete power, control and interlock wiring diagrams. Include complete operating and maintenance instructions.
- B. Shop drawings for each complete chilled water and condenser water treatment system and its chemicals shall include catalog descriptions of all components, written functional descriptions of all operation phases, shop drawings showing arrangement of all components and their enclosing cabinetry, schematic flow diagrams of all treatment system related piping to and from where such piping components connect into and are located in the other piping systems, and all other information necessary to assure that the treatment system(s) are satisfactory and completely as specified.

1.5 PRESSURE AND TEMPERATURE RATINGS

- A. Unless otherwise specified in this section, components of this equipment or system (specified by this section) which are connected to the fluid system (chilled water, condenser water, potable water, etc.) to which this equipment or system serves shall be recommended and rated for same (or greater) maximum working pressure and

temperature conditions which are applicable to the fluid system at the location(s) at which the equipment and systems of this section are installed. Refer to specification section(s) describing the related fluid systems(s) for pressure and temperature ratings applicable to the components of this section.

## 1.6 MANUFACTURER QUALIFICATIONS

- A. Chemicals, service and equipment shall be supplied by a single water treatment company for undivided responsibility.
- B. The water treatment chemical and service supplier shall be a recognized specialist, active in the field of industrial water treatment for at least ten years, whose major business is in the field of water treatment, and shall have regional water analysis laboratories, development facilities and service department, plus full-time personnel located within the trading area of the job site.

## 1.7 MANUFACTURERS

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Mogul
  - 2. Mitco
  - 3. Betz

## PART 2 - PRODUCTS

### 2.1 CONDENSER WATER TREATMENT SYSTEMS

- A. Process Controller: Provide a microprocessor type controller for controlling conductivity, pH and chemical treatment in cooling water systems. System shall incorporate current state-of-the-art microprocessor technology including integrated circuits and digital LCD displays. Instrumentation will be housed in a primed and painted NEMA 4 enclosure with a key-lock door with window. The controller shall have the following features and capabilities:
  - 1. Key Pad Control: All measurements, setpoints, calibration adjustments, program data and real clock time shall be accessed through a 20 key, chemical resistant membrane key pad. Calibration shall not require any mechanical adjustments.
  - 2. LCD Display: All measurements, setpoint and program data accessed through the key pad shall be digitally indicated on a four line, 40 character per line back lit liquid crystal display (LCD). Individual screens of information shall be displayed for the following functions with commands prompting the operator to change setpoints and access the program operating data. Individual screens of information shall be provided for normal operation, conductivity setpoints, pH

setpoints, alarm status, feed limit timers, calibration, temperature setpoints, drum levels, real clock time and auxiliary analog/digital inputs as required.

3. Conductivity Monitor: Provide linear, temperature compensated measurements over the full range of 0-10,000 micromhos. Accuracy shall be 1% of reading, with a hysteresis of plus or minus 30 micromhos over a temperature compensated range of 5-60 degrees centigrade. Bleed-off shall be controlled in the following manner:
  - a. Standard Operation: Conductivity controller shall actuate solenoid bleed-off valve when cooling water system level of dissolved solids reaches or exceeds the setpoint.
  - b. Biocide Operation: A secondary bleed-off setpoint will be used to lower system conductivity levels prior to biocide feed. This circuitry will insure increased bleed-off prior to biocide feed so that the dissolved solids levels will not rise above standard operation setpoint during biocide feed, when bleed-off lock-out timer is activated.
  - c. In both operating modes, an independent bleed limit timer with alarm shall safeguard against excessive bleed-off.
4. pH Control: The pH of the recirculating condenser water shall be controlled by a voltage regulated, fully integrated controller with linear measurements over its full range of 0-14 pH. Two independent control setpoints shall be provided for feed of acid and/or caustic chemicals. An adjustable feed limit timer with alarm shall be provided for each pH control chemical used.
5. Chemical Feed Controls: Each individual chemical feed shall be capable of operating in one of the three following modes and be independently field programmable:
  - a. Percentage Timer: Chemical fed on an adjustable time-proportioning basis initiated by bleed-off.
  - b. Counter/Timer: Chemical fed proportional to make-up water rate. A water meter with an electric contactor shall pulse a solid state reset counter with an adjustable range of 0-99 counts. Completion of counter cycle will initiate solid state reset timer for chemical feed with an adjustable range of 0-10 minutes.
  - c. Clock Timer: Chemical feed is programmed by a 24 hour timer with 1, 7, or 28 day repeating cycle. Each chemical feed interval will be programmed for start time and duration with up to 16 intervals per function.
6. Auxiliary Analog/Digital Inputs: Seven auxiliary channels will be available for other analog input signals as required (ORP, corrosivity, flow rate etc.). Four digital input channels will be available for water flow interlock, make-up water meter, bleed-off water meter and for a spare channel.

7. Security Code: Controller programming changes shall be accessible only by entering an authorized security code.
8. Drum Level Monitoring: Each chemical drum used shall be monitored by a drum level sensor which will continuously sense the amount of chemical remaining and alarm when the level has dropped to a predetermined, adjustable level (setpoint). The LCD display shall show the level remaining in each drum and the drum level alarm setpoint. This setpoint is to be adjustable from 0-100% in the field. Low drum level alarms shall display low drum level, lockout chemical pump and activate alarm buzzer.
9. Power Outage Protection: The control system will have two forms of power outage protection:
  - a. A lithium cell battery will provide power for real time clock/calendar for not less than two years.
  - b. Setpoints, calibrations, feed schedules and all other user option inputs and software shall not require battery back-up and shall be capable of being maintained in the control system for a minimum of 10 years without power.
- B. Chemical Feed Pumps: Provide four (4) chemical feed pumps of the positive displacement type, with ball-type check valves and necessary polyethylene discharge tubing for the feed of acid, corrosion inhibitor and two biocides. Pump materials of construction shall be compatible with chemicals being used.
- C. Water Meters:
  1. Provide a water meter for each condenser water treatment system. Meter shall measure make-up water to provide an impulse based on the same gallons per impulse contact (i.e., each meter shall produce an impulse when 100 gallons has passed through it). Meter shall be complete with electrical contacting register and be sized to meter twice the combined volume of make-up and bleed-off water rate of the system. Meter shall measure water quantity from the water make-up piping system.
  2. Provide a water meter bleed system which will measure the cooling tower bleed from the cooling towers. The bleed measuring meter shall be arranged and installed so that bleed water shall discharge to a suitable and approved discharge point. The discharge point shall be into the sanitary drainage system. The bleed meter shall be Hershey or acceptable equivalent and shall be approved and acceptable to the authority(s) having jurisdiction over the disposal of the water system into which the bleed discharges.
- D. Drum Level Sensor Assemblies: Provide four (4) drum level sensor assemblies each with a PVC bung hole adaptor to mount directly into 55 gallon chemical drum bung hole. Each sensor will measure amount of chemical remaining in drum and transmit a signal.

- E. Prepped Bleed-Off Assemblies: Provide one (1) prepped bleed-off piping assembly consisting of inlet shut-off valve, wye strainer flush valve, throttling valve and 0 PSI differential brass solenoid valve. Bleed-off piping assembly shall be sized to bleed twice the maximum bleed-off rate of the system.
- F. Sample Stream Injection Assembly: Provide one (1) sample stream injection assembly, with stainless steel diffuser tube for injecting sample stream flow into the recirculating line.

## 2.2 CHEMICAL TREATMENT SYSTEM - CHILLED WATER

- A. For the chilled water system, provide a shot feeder with funnel, and air release valve, minimum five gallon capacity and designed to meet pressure requirements of the system.

## 2.3 WATER TREATMENT CHEMICALS - CONDENSER SYSTEM

- A. Furnish one year's supply of recommended organic non-metallic scale and corrosion preventative in the open recirculating system. Provide two separate formulas for prevention of microbiological growth in the same system. Biocide products recommended shall be properly registered with the Environmental Protection Agency and EPA registration number shall be clearly shown on all product literature and drum labels. To insure operator safety all chemical products shall be provided in liquid form for direct feed from shipping container to the cooling system.

## 2.4 WATER TREATMENT CHEMICALS - CHILLED WATER SYSTEM

- A. Furnish one year's supply of recommended formula for scale and corrosion preventative protection of closed recirculating system. Formulation shall not contain any ingredients which are harmful to system materials.

## 2.5 TESTING EQUIPMENT

- A. Furnish basic water test equipment including spare reagents for maintaining control of program standards in the condenser and chilled water systems.
- B. Provide one test cabinet suitable for wall mounting for storage of testing glassware and reagents. The cabinet will have one shelf, keylock door and fluorescent light. Cabinet shall be constructed of 18 gauge, cold-rolled steel, primed and painted with white, polyurethane enamel paint for corrosion protection.
- C. Corrosion Testing Assembly: Provide a coupon by-pass assembly to monitor effectiveness of the corrosion prevention program. This prefabricated assembly shall include:
  - 1. 1" inlet and outlet shut-off valves.
  - 2. 1" line strainer with 20 mesh stainless steel screen.
  - 3. Corrosion probe connection fitting.
  - 4. Two (2) corrosion coupons with holders.

- 5. Two (2) corrosion coupon tees.
- 6. Flow control valve.
- D. Corrosion coupons will be analyzed by standard laboratory test methods and test reports provided at six month intervals.
- E. Basis of Design: Mogul Packaged Microchem 4000.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install chemical feeding systems as indicated, in accordance with manufacturer's installation instructions, and with recognized industry practices, to insure equipment complies with requirements and serves intended purposes.

### 3.2 SHOT FEEDERS

- A. Install shot feeders as indicated with adequate pressure differential restrictive devices to permit flow through the chemical feeder body. Connect feed piping to inlet and outlet connections with shutoff valves. Pipe drain valve discharge to floor drain.

### 3.3 ADDITIONAL INSTALLATION REQUIREMENTS

- A. Install cooling tower chemical feed equipment in accordance with manufacturer's instructions. Provide all support shelves, brackets, mounting boards and hardware and shall have appropriate supply of chemicals for start-up of system and full operation of initial system fill.
- B. Connect condenser water treatment piping system to mechanical systems as indicated, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union or flanges on supply and return, drain valve on drain connection.

### 3.4 CLEANING AND FLUSHING

- A. All condenser and chilled water lines and related equipment shall be thoroughly flushed out with precleaning chemicals designed to remove deposition such as pipe dope, oils, loose rust and mill scale and other extraneous materials. Add recommended dosages of precleaner chemical products and circulate throughout the water system. The chemical supplier shall instruct as to the proper feed rates, shall check that the cleaning solution is actually in each system, shall instruct the Contractor as to when to flush the system and shall check each system following flushing to insure all cleaning chemicals have been removed from each system. Mechanical trades shall open all modulating valves, zone valves and all other system

restrictions. Drain, fill and flush water system until no foreign matter is observed and total alkalinity of the rinse water is equal to that of the make-up water.

1. Chemical used for cleaning of systems shall comply with the recommendations of the manufacturers of the major components in the system.
2. A certificate of cleaning shall be provided by the cleaning chemical supplier to the Owner.
3. Following system flushing, upon initial fill, the approved chemicals which provide a protective coating are to be added to prevent oxidation of the piping system.

### 3.5 MANUFACTURER'S SUPERVISION

- A. Provide the services of a representative of the water treatment control manufacturer and the water treatment supplier to provide supervision of the system installation and operation check out and startup service for the complete water treatment system.

### 3.6 EQUIPMENT PLACEMENT AND MOUNTING

- A. The equipment and devices shall be located essentially as shown on the drawings; however, actual placement shall be verified using field measurements, installation diagrams and data relating to the equipment actually approved for installation on this project. The equipment, including accessory devices, shall be mounted in strict accordance with the manufacturer's instruction in such a manner as not to compromise service or operational access to any part of the system or to existing equipment.

### 3.7 PIPING

- A. Installation of chemical piping shall be made in strict compliance with the tube and fitting manufacturer's recommendations.

### 3.8 OPERATING INSTRUCTIONS

- A. Provide the services of an authorized representative of the automatic water treatment control manufacturer and the water treatment supplier to provide on site operating and service instruction of the Owner's designated operating personnel for a period not less than one day (8 hours). Instructions in routing maintenance, testing and control shall be given to Owner's authorized personnel in person by the chemical treatment specialist. This shall be done at the site. Typewritten instructions shall also be provided. Copy of instructions shall be signed by Owner's authorized personnel and sent to engineer by the contractor. Test kits shall be provided to Owner and receipt thereof acknowledged on copy of written instructions which are sent to Engineer.

### 3.9 OTHER REQUIREMENTS

- A. Provide all necessary pipe, valves, fittings, unions and other items necessary for proper installation.
- B. Locate shot type feeder in valved bypass from pump discharge to pump suction. Provide gate valve in bypass on each side of feeder.
- C. All components (including pumps, meter, piping, hose, valves, etc.) and their capacities shall be properly sized for proper chilled water and condenser water treatment.
- D. Fully coordinate entire system with cooling tower installation so that all bypasses, connections, valves, etc. necessary for the proper functioning of the condenser water treatment system are provided.

END OF SECTION



## SECTION 233100 - DUCTWORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide complete duct systems as indicated. Systems shall include, but not be limited to, the following: outside air, exhaust air, and air conditioning supply and return air duct systems as shown on drawings. Drawing scales prohibit the indication of all offsets, fittings, and like items; however, these items shall be installed as required for the actual project conditions at no change in contract price.
- B. Items Included: This section generally includes, but is not limited to, the following major items:
  - 1. Low pressure sheet metal ductwork.
  - 2. Acoustical thermal duct liner.
  - 3. Low pressure fiberglass ductwork.
  - 4. High pressure sheet metal ductwork, round and flat oval.
  - 5. High pressure sheet metal ductwork, rectangular.
  - 6. Low pressure flexible ducts.
  - 7. High pressure flexible ducts.
  - 8. Other special duct systems.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to other applicable portions of the Drawings and Specifications.
- B. This section is directly related in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Sections describing air handling equipment and fans.
  - 2. Air distribution devices.
  - 3. Terminal units.
  - 4. Duct system accessories.
  - 5. Insulation.
- C. Coordinate shop drawings, ordering, delivery, and placement of all items affecting the duct systems including, but not limited to, the following items: air handling units, exhaust fans, supply fans, sound attenuators, duct mounted coils, access panels, air distribution devices, fire dampers, outside air louvers, hoods, filters, roof curbs,

structural framing, roof construction, roofing, and the work of all trades to insure an orderly and timely progression of the work. Refer to the requirements of Section entitled "General Mechanical Provisions".

- D. Refer to other sections which may describe additional sound attenuation measures which may relate to this section.

#### 1.4 SHOP DRAWINGS

- A. Refer to Section entitled "General Mechanical Provisions". Include complete data as applicable to this project on: all prefabricated duct and fittings; duct liner including mechanical fasteners and adhesives; duct sealing materials; duct joining and seaming methods; and all other items. If required by Architect, prepare and submit for approval completely detailed shop drawings of supply and return ductwork from any or each air handling unit through its transitions, bends and elbows until such ducts are extended beyond the air handling unit equipment area and/or congested areas; these shop drawings will not be required unless specifically called for elsewhere or unless significant deviation from the Drawings is necessitated by the equipment provided.

#### 1.5 OTHER REQUIREMENTS

- A. Provide all ductwork and components thereof in accord with manufacturer's recommendations. All ductwork dimensions indicated are nominal free clearance internal dimensions which do not include insulation thickness.

#### 1.6 DEFINITIONS

- A. "SMACNA" means "Sheet Metal and Air Conditioning Contractors National Association, Inc."
- B. Low Pressure Ductwork: Any and all ductwork conveying air or other gases at velocities less than 2500 fpm and static pressure less than 2.0 inches wg. This ductwork may also be referred to in these specifications as "Low Velocity Ductwork". SMACNA "HVAC Duct Construction Standards, Metal and Flexible", Second Edition, 1995, shall govern construction of this ductwork unless otherwise specified.
  - 1. Where and if fiberglass ductwork is specified, it shall be considered only for low pressure classification use and shall be constructed in accord with SMACNA "Fiberglass Glass Duct Construction Standards", Fifth Edition, 1977.
- C. High Pressure Ductwork: Any and all ductwork conveying air or other gases at velocities equal to or greater than 2500 fpm or static pressure equal to or greater than 2.0 inches wg. This ductwork may also be referred to in these specifications as "High Velocity Ductwork" or "Medium Pressure Ductwork", but shall be considered, in either terminology, to fall within pressure/velocity class (PV/C designation) 3 to 10. SMACNA "HVAC Duct Construction Standards, Metal and Flexible", Second Edition, 1995, shall govern construction of this ductwork unless otherwise specified.

#### 1.7 PRESSURE/VELOCITY CLASSIFICATIONS

- A. Pressure and velocity classifications (hereinafter called "P/VC") for ducts are defined as follows:

P/VC Desig.	SMACNA Pressure Class	Static Pressure Rating	Positive or Negative	SMACNA Seal Pressure Class	Maximum Velocity (fpm)
10	High	10"	+	A	2000 up
6	Medium	6"	+	A	2000 up
4	Medium	4"	+	A	4000 dn
3	Medium	3"	+ or -	B	4000 dn
2	Low	2"	+ or -	C	2500 dn
1	Low	1"	+ or -	C	2500 dn
½	Low	1/2"	+ or -	C	2000 dn

- B. See Part 3, EXECUTION, of this section for duct sealing requirements.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Materials shall comply with current SMACNA standards.
- B. ASTM: Unless otherwise specified, ASTM material specifications applicable are:

Material	Type	ASTM Number
Galvanized steel	G90	A525
Stainless steel	304,316	A240
Cold rolled steel	20-28 ga.	A366
Cold rolled steel	18 ga.	A619
Aluminum	3003 H-14	B609

- C. Special Materials, Gauges and Construction:

1. Special Materials: Where special duct material other than galvanized steel is required, such duct material (e.g., fiberglass, stainless steel, plastic such as polyvinylchloride, etc.) shall be specifically indicated.
2. Gauges: Gauges indicated in this section are for galvanized steel. Where greater or lesser gauges are specifically indicated for a sheet metal material other than galvanized steel, provide the indicated gauge. Comply with the SMACNA construction standard covering the required material if no gauge is given.

3. Construction: Comply with indicated special requirements (i.e., such as welding, soldering, etc.) where application requires.

## 2.2 LOW PRESSURE SHEET METAL DUCTWORK

- A. Material: Prime quality forty-eight inch wide resquare tight coat galvanized steel conforming to the requirements of ASTM A-525 and/or A-527 as applicable to the intended use.

- B. Construction:

1. Construct to comply with the pressure/velocity classification(s) indicated.
2. Use rectangular or round as indicated on drawings.
3. Reinforcing, Cross Breaking, Seams, Joints: Be in accord with latest SMACNA construction standard for low pressure sheet metal duct.
4. Gauge: As required by SMACNA for the dimensions and pressure/velocity classification involved.

- C. Insulation:

1. Rectangular rigid sheet metal ductwork: shall be internally lined with acoustical thermal duct liner if so designated.
2. Round rigid sheet metal ductwork: Where low pressure round ductwork is designated to have internal acoustical/thermal liner, provide factory fabricated double wall ductwork as specified for high pressure round acoustically lined sound attenuating duct (i.e., factory fabricated double wall duct with perforated inner wall).

## 2.3 ACOUSTICAL THERMAL DUCT LINER

- A. Line ductwork where indicated. Dimensions indicated are net inside dimensions. Liner shall be one inch thick, three pound density fiberglass duct liner with the surface in contact with moving air stream stabilized with black pigmented neoprene. Duct liner shall comply with requirements of NFPA 90A as to flame spread and smoke developed ratings. Duct liner shall be factory treated with antimicrobial/antibacterial treatment to prevent formation & growth of bacteria.
- B. Acceptable Manufacturers: Johns-Manville, Microtex; PPG Industries, Testrafine; or Certain-Teed/Saint Gobain, Coated Ultralite.
- C. Attachment: Attach to the interior of sheet metal ducts using a full coverage coat of Foster's 85-20 adhesive and mechanical fasteners applied as follows:

1. Horizontal Ducts: Install mechanical fasteners on underside of the tops of ducts over twelve inches in width and on the insides of ducts over sixteen inches in height.
  2. Vertical Ducts: Install mechanical fasteners on all duct surfaces exceeding twelve inches.
  3. Fastener Spacing: Install fasteners within two inches of the leading edge of each duct section and within three inches of the leading edge of cross joints in insulation within any given duct section. Pins shall thereafter be spaced at not more than fifteen inches on centers. Pins shall be installed in strict accordance with manufacturer's instructions.
- D. Edge Stabilization: All exposed edges and the leading edge of all cross joints of liner shall be coated with Foster's 30-36.

## 2.4 LOW PRESSURE FIBERGLASS DUCTWORK

- A. Material: One inch (1-1/2") thick glass fiber ductboard, meeting requirements of NFPA 90A and shall have a factory applied UL 181, Class 1 air duct listing label. Board shall be faced with aluminum foil. Inside surface shall be factory treated for microbial bacterial growth prevention.
1. Fabricated from or lined with non-corrosive, non-hydroscopic, permanently odorless, resilient, long staple, fabric grade glass fibers preformed into semi-rigid or rigid board.
  2. Flexural rigidity rating of 800EI per ASTM test number D 1037 64 where neither width nor depth or duct exceeds 48 inches.
  3. Flexural rigidity rating of 1400EI per ASTM test number D 1037 64 where width or depth exceeds or equals 48 inches.
  4. Non-erosive when conveying air at velocities equal to or less than 2000 fpm.
  5. Approved, fire retardant, moisture sealing, factory-applied jacket made of kraft paper and 2 mil minimum thickness aluminum foil.
  6. Maximum thermal conductivity of 0.23 at 75°F mean temperature.
- B. Fabrication: Ductwork fabrication shall be in accordance with SMACNA Fibrous Glass Manual, Duct Construction Standards, and current manufacturer's literature on approved fabrication methods.
- C. Closure Systems: Closure systems shall be as specified by manufacturer of the ductboard to maintain the UL Class 1 duct label. Provide closure of all joints using 9/16" outward clinch staples, approximately two inches (2") wide pressure sensitive

tape. Use factory molded male-female joints wherever possible. Use appropriate UL and SMACNA approved tapes.

- D. Acceptable Products: Johns-Manville Micro-Aire Type 475 or 800 as applicable; Owens Corning Fiberglass Type 800FR or 1400FR as applicable; or approved equal.

## 2.5 HIGH PRESSURE DUCTWORK, ROUND AND FLAT-OVAL

### A. General:

1. Comply with current SMACNA standards.
2. Factory fabricated portions shall be made by United McGill, Semco or equal.

### B. Straight Conduit: Galvanized steel unless otherwise indicated for a specific application.

1. Seam construction: Spiral lock-seam (SMACNA Type RL-1) allowed for all pressure/velocity classifications. Longitudinal grooved seam (SMACNA Type RL-5) allowed only up to pressure/velocity classification P/V-C-3.

### C. Fittings:

1. Material: Same as connecting duct system.
2. Configuration: Standard design as manufactured by United McGill, Semco or equal.

#### 3. Elbows:

- a. General: All mitered elbows must be vanned.
- b. Round: 5-inch diameter and larger shall be five-section construction; less than 5-inches diameter shall be die-formed.
- c. Flat-oval: Five-section construction.
- d. Hard turn oval elbows shall have vanes as follows:

Equivalent diameters	Number of Vanes
10" through 14"	3
15" through 19"	4
20" through 60"	5
Over 60"	12" spacing

4. Vanes: Be minimum 20 gauge and limited to 24 inches of unsupported length. The leading edge of all vanes in duct exceeding 20 inch size will be hemmed with a 1/2 inch fold back.
5. Divided Flow Fittings: All divided flow configurations are to be furnished as separate fittings. Tap covers welded into spiral duct sections are not acceptable.

All tees, crosses and laterals up to an including 12" diameter tap size, will have a minimum 3/8" radius rounded entrance into the tap, produced by machining, press forming, or hand grinding to a smooth entrance. The entrance will be free of projections, weld buildups, burrs or irregularities. All fittings will have continuous welds along all seams.

6. Tees and Crosses: All tees and crosses shall be the spun conical type with branch entrances through 12" size, to be rounded laminar flow as noted above.
  7. Connections: Connections of conduit to fittings shall be made with a synthetic rubber sealing compound conforming to NFPA 90A as to flame spread and smoke developed ratings and mechanically fastened with drive or twist screws, and all joints tested in accordance with test procedure described hereinafter. Raychem TDB duct sealing bands may be used in lieu of the sealing compound. Connection between conduit and terminals shall be made with a maximum of 48" of flexible duct. Runout connections shall be assembled in same manner as conduit and fittings.
- D. Gauge: Minimum gauge as follows (gauges are for round and flat-oval duct with spiral lock-seam construction unless otherwise indicated):

1. Round duct (galvanized steel):

Diameter (Inches)	Gauge	Alternate Gauge(2)
3 thru 8	26	24
9 thru 14	26	24
15 thru 26	24	22
27 thru 36	22	20
37 thru 50	20	20
51 thru 60	18	18
61 thru 84	18(1)	16

(1) Must be 16 ga. when static pressure is negative.

(2) Alternate gauges are allowable for longitudinal grooved seam (SMACNA Seam Type RL-1) and only for pressure/velocity class up to P/VC-3.

2. Flat-oval duct (galvanized steel):

Major Dimension (Inches)	Gauge
0 thru 24	24
25 thru 36	22
37 thru 48	22
49 thru 60	20
61 thru 70	20
71 and up	18

E. Fittings:

1. Round duct: Same as duct unless otherwise recommended by manufacturer.
2. Flat-oval duct:

Major Dimension (Inches)	Gauge
0 to 24	20
25 to 36	20
36 to 48	18
49 to 60	18
61 to 70	16
71 and up	16

- F. Acoustically Lined Sound Attenuating Round and Flat Oval Duct and Fittings: General construction is specified in paragraphs above. Flame spread and smoke developed ratings shall comply with NFPA 90A. Double walled with zinc coated solid sheet steel outer wall and zinc coated perforated sheet steel inner wall. One inch thick annular space between inner and outer walls uniformly packed with fiberglass insulation with effective thermal conductivity of 0.27 BTUH per sq. ft. (F° per inch) separated from air stream using mylar film. Equal to United Acousti-K27.

2.6 HIGH PRESSURE DUCTWORK, RECTANGULAR

A. General:

1. Airtight and structurally stable at maximum system operating pressure.
2. Any welding shall be continuous and corrosion resistant.
3. Galvanized sheet steel unless otherwise indicated for a specific application.
4. Reinforced and supported to neither cause nor convey any objectionable vibrations.
5. Be in accordance with latest SMACNA construction standard for high pressure ductwork.

- B. Turning Vanes: Adequate rigidity and strength to be completely flutterproof. Airfoil, permanently fixed type constructed of galvanized steel or aluminum with sound attenuating fiberglass inner liner with open protective metal facing. Quantity in each elbow in accordance with manufacturer's recommendations. Airsan Acoustiturn as made by Air Filter Corporation, 4554 W. Woolworth Ave., Milwaukee, Wisconsin 53218 or equal.

2.7 HIGH PRESSURE DUCT RELIEF AND ACCESS DOORS

- A. Provide suitable size for access to heaters, dampers and other equipment installed in duct, and at other points indicated on drawings. Size shall be as listed by paragraph above and compatible with duct size but not smaller than 8"x12". Doors shall be 24



US gauge galvanized steel hinged to a 24 gauge galvanized mounting frame and for insulated duct shall be double panel construction with 1/2 inch rigid insulation material between metal panels. Doors shall be United Sheet Metal Type AR or an approved equal.

## 2.8 LOW PRESSURE FLEXIBLE DUCTS

### A. General:

1. The inclusion of flexible ducts in this specification shall not be construed as approval of use on the project unless specifically shown on the Drawings.
2. Where used, provide in factory finished lengths not in excess of lengths required to make kink-free connections with minimum air pressure drop.

B. Insulated flexible ducts: Flexible duct shall be factory-fabricated preinsulated type with seamless vapor barrier. Duct shall bear UL 181 Class 1 Air Duct label and shall comply with NFPA 90A and 90B. Fiberglass insulation nominal 1" thickness with thermal conductance of 0.23 BTU/hr-ft<sup>2</sup>-°F maximum at 75°F mean temperature. Flexible duct shall have an operating range of minus 0.5" w.g. to plus 2" w.g. Core shall be continuous and consist of aluminized mylar laminated to corrosion resistant steel wire helix. Vapor barrier perm rating shall be 0.17 maximum per ASTM E96-A. Maximum working velocity shall be 4000 FPM. Flexible duct shall be Genflex SLR-25, Cleavflex Type KQ, Wire Mold type WG, Flexmaster Type 5B, or approved equal.

C. Un-insulated flexible ducts, steel: Flexible ductwork shall be constructed of all metal one ply hot-dipped galvanized steel, closely corrugated for strength and flexibility, with seams interlocked, folded flat, and knurled to insure tightness. Duct shall be listed as #UL181 "Flexible Air Duct", Class 1, and NFPA 90A. Products shall be Flexmaster Type NI-TL, Clevaform Type GS or approved equal.

### D. Round branch take-off fittings for flexible duct:

1. Round duct branch take-off fitting shall be made of galvanized sheet metal designed for twist-in installation and to assure minimum air loss at the take-off. The fittings shall be of the conical converging type to reduce the pressure drop through the fittings. Provide a raised bead on the throat of the fitting to assure a tight positive connection. Products shall be Flexmaster Model CB-DE-BO3 or approved equal.
2. Provide each fitting with the following:
  - a. Lockable quadrant damper.
  - b. 45-degree extractor scoop.
  - c. Insulation guard where used with internally lined ductwork.
3. Provide these "spin-in" type fittings at all connections between rigid sheet metal duct and flexible duct at the upstream end of the flexible duct.

## 2.9 HIGH PRESSURE FLEXIBLE DUCTS

- A. Meet all requirements for low pressure flexible ducts except be recommended by manufacturer for high pressure application.

## 2.10 FLEXIBLE STAINLESS STEEL EXHAUST DUCTS

- A. Flexible ducts shall be factory fabricated uninsulated all metal type. Ducts shall be spiral flexible lockformed from type 302 stainless steel strips of 0.18" to 0.20" minimum thickness. Ends of individual duct lengths shall be plain for connection to ductwork collars and for securing to collars with stainless steel band clamps. Flexible duct lengths shall suit the usage and purpose requirements of the devices served by the flexible ducts. Flexible ducts shall have an operating range of minus 3.0" w.g. to plus 3.0" w.g. Maximum working velocity shall be 4000 FPM. Minimum allowable inside bend radius shall be no greater than four and one-half duct diameters. Flexible ducts shall be Universal Metal Hose Company "U-120", Flexmaster Type SS-NI-TL, or approved equivalent.

## 2.11 RIGID STAINLESS STEEL EXHAUST DUCTS

- A. Food Service Equipment Exhaust Ducts: Exhaust ducts which are intended to remove air laden with grease vapor and/or water vapor from cooking ranges, fryers, ovens and similar cooking equipment shall be as follows:
  - 1. Construct ductwork and vertical exhaust duct stackheads of stainless steel ANSI type 304, mill finish, 16 gauge minimum.
  - 2. Exposed locations shall have No. 4 polished finish.
- B. Exhaust Ducts for Laboratory Fume Hoods and Ethylene Oxide Sterilizers:
  - 1. Construct ductwork and vertical exhaust duct stackheads of stainless steel ANSI type 302, mill finish.
  - 2. Ductwork in exposed locations shall have No. 4 polished finish.

## 2.12 OTHER SPECIAL DUCT SYSTEMS

- A. Perchloric Acid Fume Hood Exhaust Ducts and Wash-Down Systems:
  - 1. Perchloric acid fume hood exhaust ductwork shall be type 316 stainless steel, flanged and gasketed. Ductwork in exposed locations shall have No. 4 polished finish.
  - 2. Provide two washdown systems for each perchloric acid fume hood system. One washdown system shall serve the hood, and the other system shall serve the exhaust ductwork and fan system.

3. Washdown systems shall include type 316 stainless steel full-jet spray nozzles with stainless steel piping to the centerline of each duct with exterior duct couplings and all interconnecting piping, including water supply and drain piping. The washdown systems shall provide complete coverage including fume hoods, ductwork, elbows, fans and stacks. All controls, valves and appurtenances shall be provided for proper operation of the systems.
4. All perchloric acid fume hood exhaust ductwork, including exhaust fans and stacks, shall be fabricated and installed by the fume hood manufacturer. All perchloric acid fume hood exhaust washdown and drain systems shall be designed, fabricated, and installed by the fume hood manufacturer.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. All duct systems shall be free of noise, chatter, vibration and pulsation under all conditions of operation. Remove, replace or reinforce as directed by the Architect/Engineer if necessary to correct such conditions.
- B. If field conditions are determined to exist which would limit the guarantee of air delivery or system performance, due notice in writing shall be submitted to the Architect/Engineer of such conditions prior to starting fabrication.
- C. Properly support and align ductwork. Ducts to be free of sag and bulge. Hang ductwork below concrete floors or roof deck with hangers set prior to pouring concrete, or from self drilling screw anchors. GUN POWDER SET ANCHORS ARE NOT PERMITTED.
- D. Where it is necessary that ducts be divided due to pipes or other obstructions which must pass through these ducts, the Contractor shall, at locations as noted or directed, provide air-stream deflectors in the duct and the duct shall be increased in size to maintain equivalent area around deflectors. Such changes shall be in accord with standard SMACNA details and shall be shown on Contractor's As-Built Drawings.
- E. Interior of ductwork visible through registers, grilles, or diffusers shall be painted flat black.
- F. Do not route ductwork through transformer vaults and electrical equipment spaces and enclosures.
- G. Construct all ductwork and accessories in accord with the latest indicated editions of applicable SMACNA construction standards. Sheet Metal and Air Conditioning Contractors' National Association.

- H. Streamline all ductwork to the full extent practical and equip with proper and adequate devices to assure proper balance and quiet draftless distribution of indicated air quantities.
- I. Protect all ductwork and system accessories from damage during construction until Architect/Engineer's final acceptance of project.
- J. Prior to ductwork fabrication, verify if all ductwork as dimensioned and generally shown will satisfactorily fit allocated spaces. Take precautions to avoid space interferences with beams, columns, joists, pipes, lights, conduit, other ducts, equipment, etc. Notify Architect/Engineer if any spatial conflicts exist, and then obtain Architect/Engineer's approval of necessary routing. Make any such necessary revisions which are minor at no additional cost.
- K. Carefully correlate all duct connections to air handling units and fans to provide proper connections, elbows and bends which minimize noise and pressure drop.
- L. Provide all curved elbows with radius ratios of not less than 1.5 unless otherwise shown or approved by Architect/Engineer. Provide all mitered elbows with turning vanes.
- M. Properly suspend all ductwork so that no objectionable conditions result (such as vibration, sagging, etc.).
- N. Coordinate any and all dimensions at interfaces of dissimilar type of ductwork and at interfaces of ductwork with equipment so that proper overlaps, interfaces, etc., of insulation and continuity of vapor barriers are maintained.
- O. If necessary where ducts interface and have different types of insulation, provide transitions so that internal free-clear dimensions of duct remain unchanged.
- P. Install horizontal low pressure ductwork at a level which maximizes length of any vertical, rectangular or round rigid duct connections to rectangular diffuser necks; however, such vertical duct connections are not required to be over 24 inches in length.
- Q. Make connections from any low pressure ductwork to terminal units (fan terminal units, variable volume boxes, etc.) with appropriate lengths of flexible duct unless other type of connection is indicated.
- R. Install all flexible round duct without kinks or similar obstructions so that pressure drop is minimized. Cut and remove excess lengths as necessary.
- S. Install horizontal rigid ductwork as high as practical above suspended ceilings so that movable light fixtures may be relocated without interference to meet any future partition relocation requirements.
- T. Insulated Duct: Where ducts will be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors,

and similar operating devices. A metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished shall be mounted on duct.

### 3.2 LOW PRESSURE SHEET METAL DUCTS

- A. If width or height of rectangular duct exceeds 12 inches, cross break or roll a cross bead in panels to increase stiffness; otherwise, use two gages heavier steel.
- B. Provide corner closures. Longitudinal seams and transverse joints shall be flat and smooth inside. Make slip joints in direction of air flow. See governing SMACNA manual for transition requirements.
- C. Fabricate offsets, turns and elbows with centerline radius equal to 1-1/2 times diameter when possible. No mitered offsets will be allowed. Provide double thickness turning vanes to assist in smooth flow of air in square elbows or elbows with centerline radius less than duct width or diameter.

### 3.3 FIBERGLASS DUCT

- A. General: Fiberglass duct is not allowed on the project unless specifically shown on the Drawings.
- B. Provide all reinforcement, bracing, suspension, workmanship and construction details for this ductwork and its accessories in strict accord with the recommendations of the Sheet Metal and Air Conditioning Contractors' National Association Fibrous Glass Duct Construction Standards or in accord with the manufacturer's recommendations, whichever is more stringent. Completed duct system(s) shall be stable and airtight at 2 inches w.g. internal static pressure. Comply with the reinforcement schedule for rectangular fiber glass air ducts as published in the SMACNA Standard.
- C. Entirely comply with NFPA Bulletin 90A and be Class I by UL-181.
- D. Miter all longitudinal corners (except seams) with jacket undisturbed.
- E. Provide ship lap construction with 1-1/2 inch minimum tape overlap on all sides of all longitudinal seams and transverse joints.
- F. All joints shall be fiber glass tape and mastic providing a UL-181 Duct Systems Class I rating.
- G. Round cross-section ducts shall be factory molded.
- H. Square and rectangular ducts shall be shop or field fabricated from flat ductboard.

- I. Metallic duct reinforcement support, and duct heater sleeves shall be galvanized steel.
- J. Fabricate offsets, turns and elbows with centerline radius equal to 1- 1/2 times diameter when possible. No mitered offsets will be allowed. Provide double turning vanes to assist in smooth flow of air in square elbows or elbows with centerline radius less than duct width or diameter.
- K. Taped joints on fiber glass ductwork shall be made by first taping the joint, then stapling through the tape on both sides of the joint interface, and then adding another layer of tape over the stapled and taped joint. Staples shall be in pairs with one staple on each side of the joint interface and with a distance between staple pairs of not greater than 3 inches as measured around the perimeter of the taped joints. Staples shall be minimum 1/2" x 1/2".

### 3.4 HIGH PRESSURE DUCTWORK

- A. In addition to other requirements, this ductwork shall be as follows:
  - 1. Any welds shall be continuous and corrosion resistant.
  - 2. Reinforced and supported to cause and/or to convey no objectionable vibrations.
  - 3. All seams and joints permanently sealed and joined in strict accordance with the manufacturer's recommendations.
- B. Conical Tees: Make all branch duct take-offs and all connections to flexible duct supplying air to terminal units with conical tees.

### 3.5 LOW PRESSURE FLEXIBLE DUCTS

- A. Flexible ducts shall not be used unless specifically indicated on drawings.
- B. If flexible duct is indicated for use on this project, it must comply with the following requirements.
  - 1. The extent of the use of flexible ductwork shall be limited to that shown on the drawings.
  - 2. Flexible duct installation shall be per SMACNA Flexible Duct Installation Standards, and manufacturers latest printed instructions, whichever is stricter. In addition the following shall apply:
    - a. Flexible duct between rigid duct and diffusers shall be a MAXIMUM of 8 feet in length and shall be fully extended with a maximum equivalent of (2) 90 degree bends (no bend shall be made with centerline radius of less than one duct diameter). No additional flexible duct shall be provided for future terminal device relocation unless otherwise specified.

- b. Flexible duct shall be supported at ends and at each 90 degree bend. Maximum permissible sag is 1/2 inch per foot of spacing between supports.
  - c. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case will the material contacting the flexible duct be less than 1 inch wide. Narrower hanger material may be used in conjunction with a sheet metal saddle which meets the foregoing specifications. This saddle must be formed to cover one-half the circumference of the outside diameter of the flexible duct and must be rolled to fit neatly around the lower half of the duct's outer circumference.
  - d. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when manufacturers recommended procedures are followed.
  - e. Hangers shall be adequately attached to the building structure (not pipe, conduit, etc.).
  - f. To prevent tearing of vapor barrier, do not support entire weight of flexible duct on any one hanger during installation. Avoid contact of flexible duct with sharp edges of hanger material. Damage to vapor barrier may be repaired with approved tape. If internal core is penetrated, replace flexible duct or treat as a connection.
3. Terminal devices connected by flexible duct shall be supported independently of the flexible duct.

### 3.6 HIGH PRESSURE FLEXIBLE DUCTS

- A. Meet all the requirements for low pressure flexible ducts.

### 3.7 FLEXIBLE STAINLESS STEEL EXHAUST DUCTS

- A. Flexible stainless steel ducts shall not be used unless specifically indicated on drawings.
- B. If flexible stainless steel duct is indicated for use on this project, it must comply with the following requirements.
  - 1. The extent of the use of flexible ductwork shall be limited to that shown on the drawings.
  - 2. Flexible duct installation shall be per SMACNA Flexible Duct Installation Standards, and manufacturers latest printed instructions, whichever is stricter. In addition the following shall apply:

- a. Flexible duct between rigid duct and terminal devices shall be fully extended with a maximum equivalent of (2) 90 degree bends (no bend shall be made with centerline radius of less than one duct diameter).
  - b. Flexible duct shall be supported at ends and at each 90 degree bend. Maximum permissible sag is 1/2 inch per foot of spacing between supports.
  - c. Hanger or saddle material in contact with the flexible duct shall be of sufficient width to prevent any restriction of the internal diameter of the duct when the weight of the supported section rests on the hanger or saddle material. In no case will the material contacting the flexible duct be less than 1 inch wide. Narrower hanger material may be used in conjunction with a sheet metal saddle which meets the foregoing specifications. This saddle must be formed to cover one-half the circumference of the outside diameter of the flexible duct and must be rolled to fit neatly around the lower half of the duct's outer circumference.
  - d. Factory installed suspension systems integral to the flexible duct are an acceptable alternative hanging method when manufacturers recommended procedures are followed.
  - e. Hangers shall be adequately attached to the building structure (not pipe, conduit, etc.).
  - f. Provide collars on rigid duct at flexible duct connection points. Connect flexible ducts to rigid ducts and to terminal devices and secure with stainless steel band clamps, or otherwise in accordance with flexible duct manufacturer's instructions.
  - g. Do not support entire weight of flexible duct on any one hanger during installation. Avoid contact of flexible duct with sharp edges of hanger material. If duct is penetrated, replace flexible duct or treat as a connection.
3. Terminal devices connected by flexible duct shall be supported independently of the flexible duct.

### 3.8 RIGID STAINLESS STEEL DUCT

- A. In addition to SMACNA recommendations and other requirements, rigid stainless steel duct systems shall comply with the following:
  1. All joints and seams shall be made with continuous welds. Ductwork shall be liquid tight and gas tight.
  2. Hangers and supports in finished areas shall be of same material as ductwork.
  3. Joints in laboratory hood exhaust duct may be flanged and gasketed at the Contractor's option.



4. Food Service Equipment Exhaust Ductwork:

- a. Kitchen exhaust ductwork of stainless steel shall be installed in accordance with NFPA 96 Standard for removal of smoke and grease laden vapors from commercial cooking equipment.
- b. Install horizontal stainless steel kitchen exhaust ductwork with a minimum slope of 1-inch per foot.
- c. Provide access panels of suitable size at 3'-0" centers minimum and at each change of direction for cleaning purposes.
- d. Changes in Shape and Direction: Construct all changes in shape or direction in such a manner as to prevent the formation of any traps or pockets which might collect grease.
- e. Cleanout Openings: Provide an opening in each exhaust duct at each change in direction of duct for the purposes of inspection and cleaning. Openings shall be at the sides and large enough to permit cleaning. In horizontal sections the lower edge of the opening shall be not less than one and one-half inches from bottom of the duct. Covers shall be constructed of the same material and thickness as the duct and shall be grease tight when in place.
- f. Standards: Comply with latest SMACNA construction standard which covers this type of duct system.

3.9 POLY-VINYL-STEEL DUCTS

- A. In addition to the requirements for low pressure sheet metal ducts and other requirements specified herein elsewhere in this section, poly-vinyl-steel duct systems shall comply with the following:
  1. All ducts and fittings shall be constructed in accordance with manufacturer's recommendations and specifications.
  2. All exposed raw edges shall be covered completely with poly-vinyl-steel sealant.
  3. Apply aerosol poly-vinyl-steel coating compound to any scratched surfaces.
  4. All sheet metal screws and fasteners shall be stainless steel.

3.10 OTHER SPECIAL DUCT SYSTEMS

A. Roof Mounted Exterior Ductwork:

1. Support all roof-mounted exterior ductwork with angle iron bracing firmly secured to roof construction and in such a manner to maintain watertight integrity of

specified roofing system. All ductwork roof penetrations and ductwork support roof penetrations shall also be provided in such a manner to maintain watertight integrity of specified roofing system.

2. All roof-mounted exterior ductwork shall be completely and permanently weatherproof including connections at air conditioning units, roof penetration points and all other points.
3. Submit shop drawings completely describing all supporting systems for this external ductwork.

B. Perchloric Acid Fume Hood Exhaust Ductwork and Wash-Down System:

1. The fume hood manufacturer shall fabricate and install all perchloric acid fume hood exhaust ductwork, including exhaust fans and stacks. The ductwork shall be routed as shown on the drawings, shall be fabricated and installed by the mechanical contractor.
2. The fume hood manufacturer shall design, fabricate and install all perchloric acid fume hood exhaust washdown and drain systems. The respective washdown water supply and drain piping systems shall be connected to domestic water supply and drain connections provided at the locations shown on the plumbing drawings.

3.11 MISCELLANEOUS DUCT SYSTEM COMPONENTS

- A. Spin-In Take-Off Fittings: Install around duct branch takeoff fittings according to manufacturer's installation instruction. Additionally seal fitting to rectangular duct with a thin bead of mastic sealant.

3.12 HANGERS AND SUPPORTS

- A. General: Comply with latest applicable SMACNA construction standard. Where sprayed fireproofing occurs, install hangers before application of such treatment and withhold installation of ducts until after application.
- B. Supports: Vertical risers and other duct runs where the method of support specified above is not applicable shall be supported by substantial angle brackets designed to meet field conditions and installed to allow for duct expansion.
- C. Fasteners: Secure hangers to steel beams or metal deck with beam clamps or drop through connections from the metal or concrete deck.

3.13 CHANGES IN SHAPE OR DIMENSION

- A. Where duct size or shape is changed to effect a change in area, the following shall apply:

1. Where the area at the end of the transformation results in an increase in area over that at the beginning, the slope of the transformation shall not exceed one inch in seven inches.
2. Where the area at the end of the transformation results in a decrease in area from that at the beginning, the slope of the transformation may be one inch in four inches, but one inch in seven inches is preferable, space permitting.
3. The angle of transformation at connections to heating coils or other equipment shall not exceed thirty degrees from a line parallel to the air flow on the entering side of the equipment, nor fifteen degrees on the leaving side. The angle of approach may be increased to suit limited space conditions when the transformation is provided with vanes approved by the Architect/Engineer.

### 3.14 CHANGES IN DIRECTION

- A. Changes in direction shall be basically as indicated on the drawings and the following shall apply:
1. Supply duct turns of ninety degrees in low pressure duct shall be made with mitered elbows fitted with closely spaced turning vanes designed for maintaining a constant velocity through the elbow.
  2. Return and exhaust duct turns of ninety degrees in low pressure duct shall be made with mitered elbows, as specified hereinbefore for supply ducts, unless radius elbows are indicated in which case they shall be constructed with a turning radius one and one-half (1-1/2) times the width (with width considered as the dimension in the plane of the turn) as measured to the duct centerline.
  3. Tees in low pressure duct shall conform to the design requirements specified hereinbefore for elbows.
  4. Branch take-offs in low pressure supply duct shall be made with extractors or splitter dampers, as indicated, in square take-offs.
  5. In high pressure duct, branch take-offs and connections to flexible duct supplying air to terminal units shall be made with conical taps.

### 3.15 IMPROPER MATERIALS OR CONFIGURATION

- A. If ductwork materials or ductwork configurations are installed which do not meet these specifications, Contractor shall remove such ductwork and replace with materials or configurations which are acceptable. Any delay in job progress will be the responsibility of the Contractor.

### 3.16 OTHER REQUIREMENTS

- A. Insulated Duct: Where ducts will be insulated, make provision for neat insulation finish around damper operating quadrants, splitter adjusting clamps, access doors, and similar operating devices. A metal collar equivalent in depth to insulation thickness and of suitable size to which insulation may be finished shall be mounted on duct.
- B. Control Devices: Properly install all control related devices which are part of the duct systems. See Section(s) describing control systems.

### 3.17 SEALING OF DUCTS

- A. Duct seal classes are as follows:
  - 1. Seal class "A": Seal all transverse joints, longitudinal seams and duct wall penetrations. Use for P/VC-4 (4" w.g.) and greater unless otherwise indicated.
  - 2. Seal class "B": Seal all transverse joints and longitudinal seams. Use for P/VC-3 (3" w.g.) unless otherwise indicated.
  - 3. Seal class "C": Seal all transverse joints. Use for P/VC-2 (2" w.g.) and lower unless otherwise indicated.
- B. Where sealing is required it shall mean the following:
  - 1. The use of adhesives, gaskets, tape systems or combinations thereof to close openings in the surface of the ductwork and field-erected plenums and casings through which air leakage would occur; or
  - 2. The use of continuous welds;
  - 3. The prudent selection and application of sealing methods by fabricators and installers, giving due consideration to the designated pressure class, pressure mode (positive or negative), chemical compatibility of the closure system, potential movement of mating parts, workmanship, amount and type of handling; cleanliness of surfaces, product shelf life, curing time and manufacturer-identified exposure limitations;
  - 4. That these provisions are applicable to duct connections to equipment and to apparatus but are not for equipment and apparatus;
  - 5. That where distinctions between seams and joints are made herein, a seam is defined as joining of two longitudinally (in the direction of air-flow) oriented edges of duct surface material occurring between two joints. Helical (spiral) lock seams are exempt from sealant requirements. All other duct surface connections made on the perimeter are deemed to be joints. Joints are inclusive of but not limited to girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum and casing abutments to building structures; that sealing requirements herein do not contain provisions to:

- a. Resist chemical attack.
  - b. Be dielectrically isolated.
  - c. Be waterproof, weatherproof or ultraviolet ray resistant.
  - d. Withstand temperatures higher than 120°F or lower than 40°F.
  - e. Contain atomic radiation or serve in other safety-related construction.
  - f. Be electrically grounded.
  - g. Maintain leakage integrity at pressures in excess of the duct classification herein.
  - h. Be underground below the water table.
  - i. Be submerged in liquid.
  - j. Withstand continuous vibration visible to the naked eye.
  - k. Be totally leak-free within an encapsulating vapor barrier.
  - l. Create closure in portions of the building structure used as ducts, e.g., ceiling plenums, shafts, pressurized compartments.
6. The requirements to seal apply to both positive pressure and negative pressure of operation.
7. Externally insulated ducts located outside of buildings shall be sealed prior to being insulated as though they were inside. If metal surfaces of ducts located on the exterior of buildings are exposed to weather, they shall receive exterior duct sealant. An exterior duct sealant is defined as a sealant that is marketed specifically as forming a positive air and water tight seal, bonding well to the metal involved, remaining flexible with metal movement and having a service temperature range of -30°F to 175°F. If exposed to direct sunlight it shall also be ultraviolet ray and ozone resistant or shall, after curing, be painted with a compatible coating that provides such resistance. The term sealant herein is not limited to materials of adhesive or mastic nature but is inclusive of tapes and combinations of open weave fabric strips and mastics.

C. Materials and applications for sealing ducts:

1. General:

- a. Complete product data on all materials used for sealing ducts must be submitted for approval prior to any duct fabrication.
- b. All sealants must be specifically recommended by their manufacturer for the purpose of sealing ducts.

2. Liquid Sealant:

- a. Use only for slip type joints where sealant is to fill small space between overlapping pieces of metal. Do not use where metal clearances exceed 1/32-inch.

- b. Sealant must be specifically manufactured for the purpose of sealing ducts.
- 3. Mastics:
  - a. Use in lieu of liquid sealant at Contractor's option.
  - b. Use as a fillet, in grooves and between flanges.
  - c. Do not use oil base caulking or glazing compounds.
- 4. Gaskets:
  - a. Use soft elastomer butyl or neoprene rubber or extruded forms of sealants in flanged joints in addition to mastic.
- 5. Tape:
  - a. Tape is not allowed on sheet metal ducts.
- 6. Combination of mastic and embedded fabric:
  - a. Use mastic/mesh/mastic as a sealant where pressure/velocity classification equals and exceeds P/VC-3 and where any spaces between metal surfaces at transverse joints or longitudinal seams or duct wall penetrations exceeds 1/16-inch.
  - b. Apply glove coat of mastic, then embed a continuous or overlapping strip of not less than 4-inch wide 10 x 10 fiberglass cloth into the mastic, then apply a final glove coat of mastic over the glass cloth.
- 7. Surface preparation:
  - a. Surfaces to receive sealant should be adequately clean (free from oil, dust, dirt, rust, moisture, ice crystals and other substances that inhibit or prevent bonding). Use solvent and/or apply a face primer if necessary to obtain adequately clean surface for adhesion.

### 3.18 LEAKAGE TESTING

#### A. General:

- 1. Test the following duct systems:
  - a. All ducts which are (1) under positive or negative pressure and (2) which are directly connected to air moving device (air handling unit, exhaust fan, supply fan or similar air moving equipment) and (3) which convey 1000-cfm or greater through their largest portion.

- b. All ducts which are (1) under positive or negative pressure and (2) which are part of a supply, return, outside and/or exhaust air system and (3) which are equal to or greater than 25 feet in length and (4) which may or may not be directly connected to an air moving device.
  2. Portions of duct to be tested shall consist of all portions from the largest cross sectional area to the air distribution device connection or to the smallest inlet or outlet point, whichever is applicable.
  3. Duct systems shall be constructed so that leakage does not exceed 5.00% of the air quantity handled by the respective fan.
- B. Allowable Leakage:
1. Leakage shall be measured during leakage test at a test pressure which is equal to the pressure/velocity classification of the duct system (e.g., a P/VC-2 duct shall be tested at 2.0 in. w.g.s.p., a P/VC-1/2 duct at 0.5 in. w.g.s.p., etc.).
- C. Test Procedure:
1. Test at time of duct installation and prior to installation of any field applied insulation and prior to any concealment in chases or similar enclosures.
  2. Duct openings (both entry openings and outlet openings) shall be capped or sealed by taping or banding a flexible plastic sheet over each opening prior to pressurizing duct. The plastic sheet shall be of adequate strength and thickness to withstand the test pressures. Use other method of sealing duct openings providing objective of test is obtained and if method of sealing is approved by Architect/Engineer.
  3. Use a fan having a minimum capacity of 300-cfm or 5% of the particular duct system design capacity, whichever is greater and which is capable of producing a duct test pressure of 150% of the duct test pressure.
  4. Test fan shall be connected to a flow measuring assembly consisting of straightening vanes and an orifice plate mounted in a straight tube with appropriately located pressure taps. Orifice assembly shall be accurately calibrated with its own calibration curve. Pressures shall be measured with U-tube manometers and corresponding flow rates obtained from the orifice performance curve.
  5. Connect test fan and orifice flow measuring assembly to the duct to be tested with a section of flexible duct.
  6. Test for audible leaks as follows:
    - a. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.

- b. Start the blower with its control damper closed (some small blowers popularly used for testing ducts may damage the duct because they can develop pressures up to 25 inches (W.G.)).
  - c. Gradually open the inlet damper until the duct pressure reaches 50% in excess of designed duct operating pressure.
  - d. Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealing has been repaired if and where necessary.
7. After all audible leaks have been sealed, the leakage should be measured with the orifice section of the test apparatus as follows:
    - a. Start blower and open damper until pressure in duct reaches 25% in excess of designed duct operating pressure.
    - b. Total allowable leakage shall not exceed five (5) percent of the total system design air flow rate. When partial sections (such as supply section, return section, etc.) of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.
  8. Correct any duct leaks which are detected either audibly or by touch regardless of whether leakage through duct system is less than allowable test leakage.

### 3.19 DEFINITIONS OF DUCT TYPES

A. Refer to the "Duct Type and Location Schedule" on the Drawings for:

1. The type of ductwork and where it is to be installed.
2. The pressure/velocity class at each location.
3. Indication of whether the ductwork is to be insulated externally or internally lined or not insulated.

SPECIFIER SHOULD REFER TO SECTION 15891, "DUCT TYPE AND LOCATION INFORMATION" FOR PREPARATION OF THE DUCT TYPE AND LOCATION SCHEDULE WHICH SHOULD BE PLACED ON THE DRAWINGS.

END OF SECTION



## SECTION 233300 - DUCT SYSTEM ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide all necessary duct system accessories to assure proper balance, quiet and draftless distribution and conveyance, and minimization of turbulence, noise and pressure drop for all supply return, exhaust and ventilation air quantities indicated.
- B. Items Included: This section generally includes, but is not limited to, the following items as may be applicable to this project:
  - 1. Flexible duct connections.
  - 2. Splitters.
  - 3. Turning vanes.
  - 4. Extractors.
  - 5. Manual volume dampers.
  - 6. Access doors.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Ductwork.
  - 2. Air distribution devices.
  - 3. All types of air handling equipment.

#### 1.4 COORDINATION

- A. Coordinate all items affecting the duct systems including but not limited to the following items: air handling units, exhaust fans, supply fans, sound attenuators, duct mounted coils, access panels air distribution devices, fire dampers, outside air louvers, hoods, filters, roof curbs, structural framing, roof construction, roofing, and the work of all trades to insure an orderly and timely progression of the work.

## 1.5 SHOP DRAWINGS

- A. Include complete data on: access doors; flexible connectors; manual volume dampers including operating hardware; extractors; turning vanes; automatic shutters and all other items.
- B. See section entitled, "General Mechanical Provisions".

## 1.6 OTHER REQUIREMENTS

- A. Provide all components in accordance with manufacturer's recommendations.
- B. All ductwork dimensions indicated which may affect items of this section are nominal free clearance internal dimensions which do not include insulation thickness.

## 1.7 DEFINITIONS

- A. "SMACNA" means "Sheet Metal and Air Conditioning Contractors National Association, Inc.".

# PART 2 - PRODUCTS

## 2.1 GENERAL

- A. Be recommended by the manufacturer for the application.
- B. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Ventfabrics
  - 2. Barber-Colman
  - 3. Tuttle & Bailey
  - 4. Dura-Dyne
  - 5. Airsan
  - 6. Titus
  - 7. Anemostat
  - 8. Young
  - 9. Metalaire
  - 10. United McGill
- C. Products which are specified may not necessarily all be required on the projects; provide those products which are applicable.

## 2.2 FLEXIBLE DUCT CONNECTIONS

- A. Provided where air handlers, fans and blowers connect to their ductwork.
- B. At least 4 inches long.
- C. Connected on each side to metal (either metal ductwork, air handling apparatus, or heavy gauge steel sleeves).
- D. For use in high and/or low pressure duct systems.
- E. Ventfabrics, Inc., "Ventglas Metaledge", or equivalent.

### 2.3 SPLITTERS

- A. Provide for adjustment of air volume to their respective branches, where indicated. Constructed of at least the same gauge galvanized steel as the duct wherein they are used, and in no instance be less than twenty-two (22) US gauge. Use in low pressure duct systems only. Be adequately sized to close off air to applicable branches. Rigidly attached to pivot rod and operating linkage. Install on raised insulated base when used in internally insulated ductwork. Splitter blades; formed in two thicknesses of metal so that entering edge presents rounded nose to air flow; length no less than one and one half times the width of the smaller branch served or twelve inches, whichever is larger. Hardware used for the construction, assembly, and operation of splitter dampers shall be as follows:
  - 1. Operators for exposed splitters and those located above "lay-in" or accessible ceiling shall be Ventlok #690 splitter damper assembly.
  - 2. Operators for concealed splitters shall be Ventlok #691 with #680 miter and #677 concealed regulator.

### 2.4 LOW PRESSURE METAL TURNING VANES

- A. Provide in all elbows, bends and tees of all low velocity supply air ducts whether or not shown in detail; provide in all elbows, bends and tees of all other low velocity ducts where portions of such ducts convey air at greater than 700 fpm average velocity. Adequate rigidity and strength to be completely flutterproof; properly designed; permanently fixed type. Aluminum, or steel with acid/solvent chemical corrosion resistant coating, or galvanized steel. Air foil type in all mitered elbows, mitered bends and tees. Air foil type must be manufactured by Titus, Tuttle & Bailey, Anemostat, Waterloo, Metalaire, Barber-Colman or other approved manufacturer. Be Barber-Colman "Airturns", Tuttle and Bailey "Ducturns", or Dura-Dyne "VR" with 24 gauge rails and hollow vanes, or equivalent.

### 2.5 HIGH PRESSURE TURNING VANES

- A. None required for this project.

### 2.6 EXTRACTORS

- A. Provide at rectangular branch duct take-offs.
- B. Use in low pressure duct systems only.
- C. Properly designed to deflect, proportion and direct the indicated air quantities to the branch duct and/or to the registers, grilles or other outlets without causing objectionable noise or pressure drop.
- D. Multivaned and adjustable.
- E. Aluminum, or steel with acid/solvent chemical corrosion resistant coating, or galvanized steel.
- F. Provided with devices for adjusting and securing the position of these deflectors; these devices shall allow adjustment of the deflectors from outside the completed ductwork without necessity for puncturing or otherwise penetrating ductwork and/or its vapor barrier.
- G. Made by Titus, Tuttle and Bailey, Metalaire, Anemostat, Waterloo, Barber-Colman, or equivalent.
- H. Be similar to Titus Model AG-45 or AG-225 Volume Extractor, Tuttle & Bailey Type VCL or VLK Vectrol, Waterloo Type DTM or DT2M Extractor, Anemostat "DTB" or "DTA" or Young Regulator "890" or 890A", or equivalent.

## 2.7 MANUAL VOLUME DAMPERS

- A. These dampers are to be other than those specified as being integral with each register, diffuser and other air outlet or inlet.
- B. Provided where indicated in the complete air distribution system(s) (including ductwork, return air plenums, etc.) to allow complete balancing of the air supply, return, ventilation and exhaust system(s).
- C. Opposed blade type.
- D. 8" maximum blade width.
- E. Made of galvanized steel, steel with acid/solvent chemical resistant coating, or steel with a sprayed or dipped aluminum rust resistant finish; flutterproof.
- F. Provided so that all damper adjustment can be made form outside the completed ductwork without necessity for puncturing or otherwise penetrating the ductwork and/or its vapor barrier.
- G. Fully adjustable and with locking device.
- H. Manufactured by Titus, Tuttle & Bailey, Anemostat, Waterloo, Metalaire, Greenheck or equivalent.

- I. Provided at a point in the ductwork which is a sufficient distance upstream from an outlet (or downstream from an inlet) to attenuate objectionable noise due to damper throttling and to preclude adverse effects on the distribution device.
- J. Based upon location of the duct in which the damper is to be installed, provide the following types:
  - 1. Dampers in ducts which are exposed or located above "lay-in" or "accessible ceilings": Young Regulator Company Model 817 or equivalent.
  - 2. Dampers in ducts concealed above plaster ceilings or behind dry wall construction: Young Regulator Company Model 817A or equivalent.
- K. Use in low pressure duct system only.

## 2.8 LOW PRESSURE DUCT ACCESS DOORS

- A. Provided for: each manual and motorized damper; fire damper; smoke damper; electric duct heater; and where access is otherwise necessary.
- B. Factory prefabricated double wall insulated type of 24 US gauge galvanized steel (of same or thicker gauge than ductwork panel in which installed, whichever is greater).
- C. Minimum size shall be as large as is compatible with duct size but in no case less than the following (provide larger sizes if necessary to permit proper access operation):

Max. Duct Dimensions	Access Door Size
11" and less	10" x 12"
12" through 16"	12" x 16"
17" and over	16" x 24"

- D. Doors shall be provided with and operated adjustable tension catches and shall be completely gasketed around their perimeters. Doors shall be Ventlok "Access Doors". Install in accordance with manufacturers recommendations using Ventlok #360 sealant or equivalent.

## 2.9 TEST OPENINGS

- A. Furnish and install gasketed capped test openings for test equipment (pitot tubes, etc.) on the entering and leaving sides of air handling unit and other air handling equipment and heating coils. Test openings shall be Ventlok #699-2 or equivalent.

## 2.10 PREFABRICATED DUCT CONNECTIONS

- A. At Contractor's option, prefabricated duct connections as manufactured by Ductmate (or approved equal system) may be used in locations and applications for which the

duct connection system is recommended. Use of these connections must meet or exceed specified duct construction quality as related to structural rigidity, pressure, accessibility and other such requirements.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Construct and install all accessories in accordance with the latest indicated editions of applicable SMACNA construction standards.
- B. Provide all mitered elbows with turning vanes.
- C. Install all duct system accessories in accordance with manufacturer's recommendations.
- D. All accessories installed in poly-vinyl-steel ductwork shall have acid/solvent chemical corrosion resistant coating.
- E. All manual damper arms shall be tagged with fluorescent colored strip.

END OF SECTION

## SECTION 233314 - DAMPERS: FIRE AND FIRE/SMOKE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. All work of this section shall be governed by all provisions of the general, supplementary and special conditions of these specifications and the drawings.
- B. Take adequate precautions to insure that installed dampers/operators are protected from damage during construction.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section "General Mechanical Provisions" for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the drawings and specifications.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Fire dampers shall comply with Underwriters Laboratories (UL) Standard 555 and bear the UL test label.
- B. Fire/Smoke dampers shall comply with Underwriters Laboratories (UL) Standard 555(S) and bear the UL test label.
- C. The sheet metal installer, in conjunction with the metal stud installer and drywall installer, shall fabricate a mock-up of each type of fire damper installation in a one-hour fire wall. The mock-ups shall contain all required framing, retaining angles, sleeves, caulking, drywall and other appurtenances as shown on the details and/or the manufacturer's installation instructions. After fabrication the mock-ups shall be approved by the Architect/Engineer. The mock-ups shall remain on the project premises to be used for reference and training purposes.
- D. Provide dampers which are to be installed in a horizontal plane with spring closing mechanisms.

#### 2.2 CURTAIN-TYPE FIRE DAMPERS

- A. Fire dampers shall be constructed with casings of 11 gauge galvanized steel with bonded red acrylic enamel finish interlocking type damper blade assembly, and fusible link rated at 160-165°F unless noted otherwise on the drawings. Provide factory furnished duct installation sleeve. Sleeve shall be minimum 16 gauge for dampers up to 36" wide x 24" high and 14 gauge for sizes exceeding 36" x 24". Dampers shall be Style "B", 100% full duct opening, and bear 1-1/2 hour UL label.
- B. Acceptable manufacturers are: Prefco, American Warming & Ventilating, Inc., Ruskin Mfg. Co., Nailor Hart, Louvers and Dampers and Air Balance, Inc., Safe Air, Greenheck or equivalent.

## 2.3 MULTI-BLADE TYPE FIRE DAMPERS

- A. Provide multi-blade type spring-driven fire dampers in types and sizes indicated, with casing constructed of 10 gauge galvanized steel with bonded red acrylic enamel finish, fusible link 160-165°F (71-74°C), unless otherwise indicated, and matching factory furnished installation sleeve.
- B. Acceptable manufacturers are: Nailor Hart, Ruskin, Louvers and Dampers, American Warming & Ventilating, Prefco and Air Balancing, Inc., Safe Air, Greenheck or equivalent.

## 2.4 COMBINATION FIRE/SMOKE DAMPERS

- A. Provide multi-blade type motor-driven fire/smoke dampers in types and sizes indicated, with casing constructed of 10 ga. galvanized steel with bonded red acrylic enamel finish, fusible link 160°-165°F (71-74°C), unless otherwise indicated, with electric or pneumatic motor, motor mounting bracket, and 32" long wire leads for connecting to smoke detector and matching factory furnished installation sleeve.
- B. Operator motor shall be mounted out of air stream.
- C. Motor operator shall be equal to Honeywell M445 (electric) or Johnson D3153 (pneumatic).
- D. Acceptable Manufacturers are: Nailor Hart, Ruskin, Louvers and Dampers, American Warming & Ventilating, Prefco, Greenheck and Air Balancing, Inc.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Provide access doors to facilitate relinking of fire and fire/smoke dampers.
- B. See installation details on plans.
- C. Adhere strictly to damper manufacturer's instructions.



- D. Install multi-blade type fire dampers in ducts at grilles and registers if and where indicated on drawings.
- E. Install curtain type fire dampers where indicated on drawings at locations other than grilles and registers.
- F. Install combination fire/smoke dampers where indicated on Drawings.

END OF SECTION

## SECTION 233425 - FANS: IN-LINE CENTRIFUGAL, LIGHT DUTY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide in-line centrifugal light duty exhaust fans of size, sound power level, and electrical characteristics indicated on drawings.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SHOP DRAWINGS

- A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on: fan external static pressure, fan rpm, motor rpm, fan tip speed, fan size, fan performance tables or curves showing all possible operating selection points for each fan size (including rating certification), fan brake horsepower, motor horsepower and electrical characteristics sound level, fan accessories, and a complete schedule worked up by fan number.
- B. Exhaust air fans shall be AMCA certified as to both sound and performance ratings.

#### 1.5 MANUFACTURER

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Acme Engineering and Manufacturing Company
  - 2. Greenheck Fan and Ventilator Corp.
  - 3. Ilg Industries, Inc.
  - 4. Powerline, Inc.
  - 5. Penn Ventilator Company
  - 6. Loren Cook Company
  - 7. Jenn Air
  - 8. Carnes
  - 9. Captive Aire

## PART 2 - PRODUCTS

### 2.1 FAN HOUSING

- A. Fan housing including longitudinal, traverse, and diagonal stiffeners, motor mounts, bearing and drive supports shall be constructed of steel. Entire fan housing shall be internally lined with 1/2-inch or greater, three pound per cubic foot density fiberglass acoustical duct liner with a stabilized surface. Liner shall be held in place with adhesive and mechanical fasteners. All insulation and adhesives shall meet requirements of NFPA 90A as to flame spread and smoke developed ratings. Housing, including all bracing, stiffeners and motor mounting assembly shall be factory finished with a baked on alkyd enamel finish over a corrosion resistant primer. Removable panel in bottom of housing for complete access to motor and fan. Inlet and outlet duct connections.

### 2.2 FAN WHEEL

- A. Shall be centrifugal type and shall be statically and dynamically balanced.

### 2.3 FAN MOTOR

- A. Permanently lubricated shaded pole motor mounted on resilient isolators to minimize vibration and noise.

### 2.4 BACKDRAFT DAMPER

- A. Mounted in throat of fan discharge.

### 2.5 DRIVE ASSEMBLY

- A. Drive shall be direct drive type as indicated on drawings, and shall conform with the requirements of Section entitled "General Mechanical Provisions".

### 2.6 DISCONNECT SWITCH

- A. Fans shall include factory mounted disconnect switches prewired to the drive motor.

### 2.7 SPEED CONTROL

- A. Solid state speed controller for speed reduction to 40%. Mounted on housing or as otherwise indicated.

## PART 3 - EXECUTION

### 3.1 FAN PLACEMENT AND MOUNTING

- A. Fan locations shall be essentially as shown on drawings; however, actual wall openings and fan placement shall be verified using field measurements and data relating to equipment approved for actual installation on this project. Mount fan in strict accordance with manufacturer's instructions.

### 3.2 SOUND AND VIBRATION CONTROL

- A. Refer to Section entitled "Ductwork" for air side sound control and to Section entitled "Vibration Isolation" for vibration control.

### 3.3 DUCT CONNECTIONS

- A. Inlet and discharge ducts shall be connected to the fan duct collars using flexible connectors. These connectors shall be installed properly so that they are not in tension and are aligned with their respective ducts.

### 3.4 TEST AND BALANCE

- A. All fan performance shall be certified as specified in section describing test and balance procedures.

### 3.5 OTHER REQUIREMENTS

- A. Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.
- B. Provide necessary anchorage and supports to prevent vibration.

END OF SECTION

## SECTION 233428 - FANS: CENTRIFUGAL, ROOF UPBLAST

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide centrifugal, roof mounted, upblast fans of size, capacity, and electrical characteristics indicated on the drawings or as otherwise indicated.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SHOP DRAWINGS

- A. Refer to the requirements of Section entitled "General Mechanical Provisions". Include complete data on: fan size, fan performance (including rating certification), fan brake horsepower, motor horsepower and electrical characteristics, sound level, roof curb, and fan accessories. The data shall take the form of engineering data sheets, clearly depicting specification compliance, and a complete schedule worked up by fan number.

#### 1.5 MANUFACTURERS

- A. Equipment items listed in the schedule on the drawings are based on a specific manufacturer to establish the desired style, quality, performance, and type of equipment. Equal products, complying with the required installation shown on the plans and with these specifications, by the following manufacturers are acceptable:
  - 1. Greenheck
  - 2. Acme
  - 3. Cook
  - 4. Penn
  - 5. Jenn Air
  - 6. Ilg
  - 7. Captive Aire

### PART 2 - PRODUCTS

#### 2.1 FAN ASSEMBLY

- A. Fan Hood, Housing, and Base: Weatherproof and constructed of heavy gauge aluminum. Discharge shall be vertical upblast provided with built-in grease drain.
- B. Fan Wheel: Backward curved, non-overloading, aluminum, air foil blade type, statically and dynamically balanced. Wheels: keyed and locked to shaft.
- C. Drive Assembly: Motor and drive assembly located out of exhaust air stream, cushioned mounted on multi-directional neoprene vibration isolators and positively ventilated. Motor and drive: supported by a structural frame independent of hood, housing, and curb base. Direct or belt drive type as indicated. Conform with Section entitled "General Mechanical Provisions".

## 2.2 SPECIAL APPLICATIONS

- A. Where these fans are used for kitchen hood exhaust and are exhausting grease fumes, the fan shall be arranged so that the fan discharge is a minimum of 40-inches above the roof. This may be accomplished by providing a companion factory housing extender or by use of a curb of extended height. Curb caps shall incorporate drainable grease troughs except where such troughs are an integral part of the fan itself. These fans shall be U.L. listed for grease removal and shall have a thermal barrier to insulate wheel compartment from drive compartment.

## 2.3 OTHER REQUIREMENTS

- A. Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection unless noted on the drawings.
- B. Provide matching factory insulated curbs to fit base of roof ventilator, 8" height minimum or as indicated on drawing, and type to suit roof construction.
- C. Provide removable bird screens, 1/2" mesh, 16 ga. aluminum or brass wire unless noted on the drawings.
- D. Isolate the entire rotating assembly and motor of each fan to prevent the transmission of vibration into the structure. The hood covering the fan motor and drive shall be hinged and provided with an approved locking device to fasten hood in closed and open position.

## PART 3 - EXECUTION

### 3.1 PLACEMENT AND MOUNTING

- A. Fan location shall be essentially as shown on the drawings, however, actual placement of roof curb shall be verified using field measurements and data relating to the equipment approved for actual installation. Mount fan and backdraft damper in strict accordance with manufacturer's instructions. Coordinate with roofing work.

### 3.2 WIRING

- A. See Section entitled, "General Mechanical Provisions". Ensure that fans are wired properly, with correct motor rotation, and positive electrical motor grounding.

### 3.3 DUCT CONNECTIONS

- A. Connect inlet ducts (where required) to roof curb inlet flanges.

### 3.4 TEST AND BALANCE

- A. Operate all power roof ventilators, adjust drive speeds to achieve design air flow, record fan motor amperes and nameplate data, and perform other requirements as indicated in section describing testing and balancing.

### 3.5 OTHER REQUIREMENTS

- A. Remove shipping bolts and temporary supports within ventilators and exhaust fans. Adjust dampers for free operation.
- B. Furnish to Owner, with receipt, 1 spare set of belts for each belt drive power ventilator and exhaust fans.
- C. Curb flashing shall be furnished under another section of these specifications. Counter flashing shall be furnished under this section.
- D. Provide necessary anchorage and supports to prevent vibration.

END OF SECTION

## SECTION 233429 - FANS: CENTRIFUGAL, CEILING MOUNTED

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide ceiling mounted light duty centrifugal fans with characteristics indicated.

#### 1.2 SHOP DRAWINGS

- A. Refer to requirements of Section entitled "General Mechanical Provisions".

#### 1.3 CERTIFIED PERFORMANCE

- A. Be AMCA certified as to both sound and performance ratings.

#### 1.4 MANUFACTURER

- A. Design Basis: Basis of design is similar to Acme Master-ette Model V Series and Greenheck CSP Series or as scheduled on drawings.
- B. Acceptable Manufacturers: Greenheck Fan and Ventilator Corporation; Ilg Industries, Inc.; Powerline, Inc.; Power Ventilator Company, Loren Cook Company; Acme Engineering and Manufacturing Corporation; Penn Ventilator Company, Captive Aire or equal.

### PART 2 - PRODUCTS

#### 2.1 FAN HOUSING

- A. Fan housing including longitudinal, traverse, and diagonal stiffeners, motor mounts, bearing and drive supports shall be constructed of steel. Entire fan housing shall be internally lined with ½-inch thick or greater, three pound per cubic foot density fiberglass acoustical duct liner with a stabilized surface. Liner shall be held in place with adhesive and mechanical fasteners. All insulation and adhesives shall meet requirements of NFPA 90A as to flame spread and smoke developed ratings. Housing, including all bracing, stiffeners and motor mounted assembly shall be factory finished with a baked on alkyd enamel finish over a corrosion resistant primer. Removable panel in bottom of housing for complete access to motor and fan.

#### 2.2 CEILING INLET GRILLE

- A. Steel or aluminum: Baked enamel finish.

#### 2.3 FAN WHEEL



- A. Shall be centrifugal type and shall be statically and dynamically balanced. Single or twin impeller as necessary to provide indicated performance.

#### 2.4 FAN MOTOR

- A. Permanently lubricated shaded pole motor mounted on resilient isolators to minimize vibration and noise.

#### 2.5 BACK DAMPER

- A. Mounted in throat of fan discharge.

#### 2.6 DRIVE ASSEMBLY

- A. Drive shall be direct drive type as indicated on drawings, and shall conform with the requirements of Section entitled "General Mechanical Provisions".

#### 2.7 DISCONNECT SWITCH

- A. Fans shall include factory mounted disconnect switches prewired to the drive motor.

#### 2.8 SPEED CONTROL

- A. Solid state speed controller for speed reduction to 40% Mounted on housing or as otherwise indicated.

### PART 3 - EXECUTION

#### 3.1 PLACEMENT AND MOUNTING

- A. Fan locations shall be essentially as shown on drawings; however, actual fan placement shall be verified using field measurements and data relating to equipment approved for actual installation on this project. Mount fan in strict accordance with manufacturer's instructions.

#### 3.2 TEST AND BALANCE

- A. All fan performance shall be certified by test and balance procedures as specified in section describing test and balance procedures.

END OF SECTION

## SECTION 233713 - AIR DISTRIBUTION DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide all air distribution devices as indicated on the drawings and as specified herein for a complete and operable system.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.
- B. Coordinate with work of the ceiling, drywall and plastering trades as required to insure an orderly progression of work and a first class finished system with respect to placement, alignment, finish, general fit and absence of conflict with lighting systems and fire protection systems.

Insulate air distribution devices to prevent condensation formation.

#### 1.4 DESIGN CONDITIONS

- A. Acoustical: Noise produced at each diffuser, register, grille or other air distribution device shall not exceed a noise criteria level of NC 35 based on sound pressure levels in db re 0.002 microbars unless otherwise indicated. Coordinate air distribution devices, sound attenuation measures and equipment actually provided to insure that this design constraint is not exceeded by the system installed.

Exceptions: Any particular rooms or areas which are normally occupied by other than maintenance staff or service staff and which may be noted on the drawings as requiring lower NC criteria.

- B. Pressure Drop: Pressure drop across any air distribution device shall not exceed 0.15 in wg static pressure unless otherwise indicated.

#### 1.5 SHOP DRAWINGS

- A. Refer to the requirements of Section entitled "General Mechanical Provisions".

## 1.6 MANUFACTURER

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Titus
  - 2. Metalaire
  - 3. Price
  - 4. Krueger
  - 5. Carnes
- B. Manufacturers must be members of the Air Distribution Council unless otherwise indicated.

## 1.7 OTHER REQUIREMENTS

- A. All aluminum is to be extruded unless otherwise indicated.
- B. Appearance: Each air distribution device which has a portion thereof (frame, core, etc.) exposed to view in the finished area shall have a factory applied finish which matches and is compatible with the color of the surrounding surface on which the device is installed. Colors must be approved by Architect prior to device fabrication.
- C. All louvers, dampers and/or shutters shall be rated by their manufacturer in accord with AMCA Standard 500-74.
- D. Integral Components: All dampers, blank-off baffles and other companion devices which form an integral part of air distribution device shall be factory made items produced by the manufacturer of air distribution device.
- E. Louvers: Louvers may be specified in another division but for reference may also be indicated on mechanical drawings.
- F. Door Grilles: Door grilles may be specified in another division but for reference may also be indicated on mechanical drawings.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Provide the following air distribution devices as applicable to this project. Refer to air distribution device schedule as shown on drawings.

### 2.2 OTHER REQUIREMENTS

- A. All devices must each comply with the applicable portions of the Air Diffusion Council (ADC) Equipment Test Code 1062R4 "Certification, Rating and Test Manual", the Air Movement and Control Association, Inc. (AMCA) Standard 500 "Test Method for Louvers, Dampers and Shutters" and the "National Fire Protection Association" (NFPA) Standard 90A "Installation of Air Conditioning and Ventilating Systems".
- B. Provide ceiling and/or linear diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of diffuser.
- C. Diffusers, grilles and registers installed in fire rated ceiling, or floor/ceiling assemblies shall be constructed of steel.
- D. Mounting Screws: Where grilles, diffusers or registers are specified which require mounting screws visible from the face of the device these screws shall be furnished with the air distribution equipment and be finished at the factory to match the finish on the grille, diffuser or register in which they are to be used.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install neatly where indicated in accord with manufacturer's recommendations and in accord with SMACNA recommendations and as otherwise indicated.
- B. Properly test, balance and adjust to produce quiet, draftless operation to best degree possible.

### 3.2 INSTALLATION

- A. Rectangular Diffusers: Where diffusers are the lay-in type, they shall be supported by the inverted T-bar suspension system but all ducts connected thereto shall be supported independently of the ceiling as specified under Section entitled "Ductwork". Surface mounted diffusers shall be supported by the duct runouts or drops where sheet metal ducts are indicated and by separate hangers where flex runouts are indicated. All rectangular ceiling diffusers shall be installed with their lines parallel and perpendicular to the building line and properly aligned with the ceiling.
- B. Sidewall Grilles and Registers: Mount securely to the duct system flanges using finish screws and in accordance with accepted good practice.
- C. Ceiling mounted Exhaust and Return Registers/Grilles: Mount as specified hereinbefore for surface mounted ceiling diffusers except use finished screws provided and secure to duct and finished ceiling (or finished ceiling for nonducted returns) in accordance with the manufacturer's instructions. Where required to provide adequate support for nonducted registers or grilles, provide appropriate mounting frame for incorporation into the ceiling system.

- D. Install all outlets and inlets as recommended by the manufacturer; in accordance with recognized industry practices; to insure that products serve intended functions.
- E. Locate ceiling air outlets and inlets as indicated on the drawings. Unless otherwise indicated, locate units in center of acoustical ceiling modules. Install square and parallel with partitions, ceiling grid members, etc.
- F. Spare Parts: Furnish to Owner, with receipt, 3 operating keys for each type of outlet and inlet that require them.
- G. Do not install blank-offs under continuous linear diffuser distribution plenums. Distribution plenums shall cover only active portion of the diffuser.

### 3.3 PROTECTION OF WORK UNTIL FINAL ACCEPTANCE

- A. Coordinate the installation of the air distribution equipment with related work and finishing of adjacent surfaces to prevent damage to the devices or adjacent finishes. Protect the finish of all air distribution equipment until final acceptance. Replace or repair to the Architect's satisfaction any damaged equipment.

END OF SECTION

## SECTION 233724 - ROOF AIR INTAKES AND RELIEF VENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide factory assembled roof air intake(s) and relief vent(s) where indicated. Sizes and operating characteristics shall be as scheduled on drawings or as otherwise indicated.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SHOP DRAWINGS

- A. Refer to requirements of Section entitled "General Mechanical Provisions". Include complete data on sizes; required clearances; direction of air flow; construction and dimensions; and capacities, static pressure losses, free areas and other operating characteristics.

#### 1.5 MANUFACTURERS

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Acme
  - 2. Ilg
  - 3. Cook
  - 4. Jenn-Air
  - 5. Penn
  - 6. Carnes
  - 7. Greenheck
  - 8. Powerline

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Sized as indicated.
- B. Low silhouette type.
- C. Rain-tight under all operating conditions.
- D. Constructed of any of the following materials: all fiberglass, spun or extruded aluminum, galvanized steel.
- E. Pass indicated air quantities at not greater than 0.05 inches w.g. total pressure or as scheduled and, for intakes only, 500 fpm maximum throat and perimeter velocity.
- F. 1/4" Mesh galvanized steel or PVC coated bird screen. Provided with parallel or opposed blade volume dampers and/or backdraft dampers where indicated.

### PART 3 - EXECUTION

#### 3.1 PLACEMENT AND MOUNTING

- A. Location shall be essentially as shown on the drawings, however, actual placement of the roof curb shall be verified using field measurements and data relating to the equipment approved for actual installation on this project. Mount items in strict accord with manufacturer's instructions. Permanently secure to roof curbs.

#### 3.2 DUCT CONNECTIONS

- A. Connect ducts (where required) to roof curb inlet flanges using flexible connectors. Install connectors properly so that they are not in tension and are aligned with ductwork.

#### 3.3 TEST AND BALANCE

- A. Unless specified otherwise and prior to requesting final inspection, operate equipment and adjust to achieve design air flow.

END OF SECTION

## SECTION 233725 - LOUVERS

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide complete louver assemblies as indicated on Drawings and in Specifications.

#### 1.2 SHOP DRAWINGS

- A. Refer to the section entitled "General Mechanical Provisions".

#### 1.3 CERTIFICATION

- A. All performance shall be certified by AMCA and bear the AMCA Certified Ratings Seal for Air Performance and Water Penetration in accord with AMCA Standard 500.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Stationary type; extruded aluminum construction.
- B. All components factory assembled by the louver manufacturer including heads, jambs, sills, blades and mullions. Louver sizes too large for shipping shall be assembled at the site from factory assembled louver sections to provide the overall sizes required.
- C. Frame:
  - 1. 4-inch depth.
  - 2. Suitable for mounting in the type of wall where indicated. Coordinate with wall construction indicated on architectural drawings.
  - 3. Extruded aluminum of 0.100-inches minimum thickness.
  - 4. Provided with caulking slots.
- D. Blades:
  - 1. Drainable type with drain gutter in each blade and downspouts in jambs and mullions.
  - 2. Extruded aluminum of 0.081-inch minimum thickness.
  - 3. Approximately 37-1/2-degree blade angle.



- 4. Blades on approximately 3-inch centers.
  - E. Finish:
    - 1. Clear anodized.
  - F. Operating characteristics:
    - 1. High free area.
    - 2. Low water penetration.
    - 3. Free area based on air velocity of not greater than 500 fpm.
    - 4. Air flow pressure drop in intake mode or exhaust mode of not greater than 0.025-inches w.g.s.p.
  - G. Design: Limit span between visible mullions to 10-feet and shall incorporate such other structural supports required to withstand a wind load of 50 lbs. per sq. ft.
  - H. Size: As scheduled or shown on Drawings or as required to comply with the above operating characteristic constraints.
- 2.2 ACCESSORIES
- A. Bird screen: Aluminum, 3/4-inch mesh, typical for all louvers.
  - B. Insect screen: Aluminum, 18-16 mesh, where indicated on drawings.
  - C. Frame: Flange, 1-1/2-inch nominal width for louvers of sizes 24" wide X 12" high and smaller; non-flanged, suitable for cased opening mounting for louvers of sizes greater than 24" wide x 12" high.
- 2.3 ACCEPTABLE MANUFACTURERS
- A. Basis of Design: Ruskin Model ELF-6375DXD. Acceptable: equivalent products of American Warming & Ventilating; Carnes; Greenheck; Krueger; Louvers & Dampers, Inc., Metal Industries; or approved equal.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Install in accord with manufacturer's recommendations and in accord with applicable portions of current SMACNA guidelines.
- B. Installation shall be watertight between complete circumference of frame and wall.

- C. Coordinate complete installation with other work related to structure, wall construction, ductwork (if any) and other such interfaces.
- D. For additional requirements, refer to Architectural drawings and other portions of the Contract Documents.

END OF SECTION

## SECTION 234100 - AIR FILTER ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Furnish and install complete air filter assemblies of the types, sizes and capacities indicated.

#### 1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

#### 1.4 SHOP DRAWINGS

- A. Include complete performance data at the scheduled operating conditions; dimensions; weights; performance curves; airside pressure losses; quantities; descriptions; and any other necessary information.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Filters shall pass applicable air quantities at velocities and pressure drops which are within manufacturer's recommended operating ranges and as specified and scheduled.
- B. Filter Manufacturers: Continental; American Air Filter; Cambridge; Farr; Flanders; Purafil; or equivalent.
- C. Filter Housing Apparatus Manufacturers: Same manufacturer as the applicable filters or same manufacturer as the air handling unit in which installed, whichever manufacturer is applicable.
- D. Air Handling Unit Filter Sections: Shall be of adequate size to accept specified filters. Air handling unit filter sections shall be factory made by air handling unit manufacturer or by filter manufacturer to be specifically compatible with applicable air handling unit.
- E. Fan Coil Unit and Fan Powered Terminal Unit Filter Box: Integral part of fan coil unit or terminal unit assembly.

1. Access: Filter sections shall be designed for side service access unless otherwise indicated.

## 2.2 REPLACEABLE THROWAWAY FILTERS, 1-INCH THICK

- A. Dacron or fibrous glass multi-ply fiber with 3 graduated density plies. Equal to Continental Conoply Type LD 3 ply, AAF 5700. Galvanized steel or aluminum or fiberboard frame suitable for mounting in applicable filter box. Minimum efficiency: 25% NBS atmospheric dust spot efficiency. Applicable uses: fan coil units; fan powered terminal units at heating coils contained therein.

## 2.3 INITIAL PREFILTERS FOR AIR HANDLING UNITS

- A. Filter Housing: Integral part of air handling unit assembly. (If not part of AHU assembly, provide external filter housing.)
- B. Filters: Extended surface, pleated panel type; disposable; double-wall chipboard frame with diagonal support members; 2-inches thick; average efficiency no less than 25-30% based on ASHRAE 52.2-99 test method; operate at an initial resistance of not more than 0.25-inches w.g.s.p. at 500 fpm face velocity. Design base: Farr 30/30.

## 2.4 FINAL PREFILTERS FOR AIR HANDLING UNITS

- A. Filter Housing: Integral part of air handling unit assembly. (If not part of AHU assembly, provide external filter housing.)
- B. Filters: Air filters shall be high performance, extended area, deep pleated, disposable type. They shall consist of a filter element, media retainer holding frame and sealer frame. The filter element shall be of the high performance, pre-formed, deep pleated, disposable type. The media shall be microfine glass fiber which is reinforced by a laminated synthetic backing. The filter shall have an average efficiency of 80-85% on ASHRAE Test Standard 52.2-99. It shall have an average arrestance of no less than 98%. The filter shall be listed by Underwriters' Laboratories as Class 1.
- C. Media retainer: shall be of welded steel construction and shall be designed in such a manner that it supports the multiple pleats of the filter element against the direction of airflow. The media retainer shall be PVC coated and designed to totally eliminate the possibility of oscillation and/or sagging. Holding Frames shall be factory fabricated of 16 gauge galvanized steel and shall be equipped with gaskets and four spring type positive sealing fasteners. Fasteners shall be capable of being attached or removed without the use of tools. Sealer frames shall be fabricated of 20 gauge galvanized steel and shall be equipped with gasketing material on the rear flange of the sealer frame.
- D. Design Base: Farr HP-100.

## 2.5 EXTERNAL FILTER HOUSING FOR AIR HANDLING UNIT FILTERS

- A. Filter Housing: Holding frame of galvanized steel reinforced with bracing and gussets; constructed to provide positive air seal and retainage of filter elements; doors equipped with heavy duty latches and resilient gasketing; designed for side access. Housing shall accept both initial and final prefilters. Applicable uses: where filter housing is not an integral part of air handling unit assembly. Design base: Farr Model 3P Universal Glide/Pack.

## 2.6 ACTIVATED CARBON FILTERS

- A. Activated carbon filters shall be the full flow high velocity type. Each filter shall contain 90 pounds of activated carbon per 2000 CFM. Filters shall be of size and quantity as indicated on the plans. The casing shall be constructed of galvanized steel: The activated carbon in each filter shall be contained in removable panels constructed of high heat, medium impact polystyrene plastic, to withstand corrosion, and so installed as to preclude the possibility of air bypass. The panels shall contain internal separators to minimize the settling of the carbon and shall be capable of being refilled by the owner. The activated carbon shall have an activity rating of at least 50 minutes by the Standard Government Accelerated Chloropicrin Test. Design base: Farr CF-4.

## 2.7 HEPA FILTERS

- A. Each module shall consist of an all metal corrosion resistant steel casing, steel center divider, filter pack, adjustable flow control, spun steel inlet collar, face screen and integral provisions for attachment of seismic restraints. Module shall be provided for use in lay-in type ceiling and shall be custom manufactured in size as required to fit the lay-in ceiling furnished.
- B. The filter pack shall be made with pleated all-glass filter media and safe-edge corrugated aluminum separators. The filter media, separators, and casing components shall be encapsulated in a high stability compound to eliminate any possibility of leaks around the filter media or through the casing joints.
- C. The flow control system shall provide each module with the capability of being adjusted to a specified discharge velocity between 25 and 110 fpm with a supply air static pressure between 0.5" and 2.0" w.g. The discharge velocity shall be uniform across the projected face of the module within a tolerance of + 20 fpm.
- D. Flow control adjustments and measurements shall be made from the discharge face of the module. A single port of volumetric flow and filter resistance measurements and adjustments and measurement of upstream test aerosol concentration shall be provided in the face of the unit.

- E. The module shall be protected by a diamond perforated anodized aluminum screen sealed to the face of the unit. The module shall provide a minimum of 5/8" of bearing and sealing surface when installed on a 1-1/2" T-Bar system.
- F. The complete module shall be manufactured, tested and supplied by filter manufacturer. The completed unit shall be tested for efficiency and leaks and certified to have a minimum efficiency of 99.99% on 0.3 micron thermally generated particles and be leak-free per Federal Standard 209B.
- G. After test and cleaning, the module face and inlet collar shall be sealed with removable shields to prevent further contamination and protect against damage.
- H. Design Base: Cambridge model CAM-1.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Arrangement and Access: Arrange, install and make provisions for easy access to and removal and replacement of filters. Provide access doors and/or panels as necessary.
- B. Coordination and Matching: Coordinate assembly components and properly match sizes and quantities of filters with related air moving systems (e.g., air handling units, fan coil units, filter banks) so that filter assemblies will operate in accord with operating conditions, sizes and capacities as listed in this section or as otherwise indicated.

### 3.2 MANOMETER

- A. Provide a filter manometer for each separate filter bank type (e.g., initial prefilter bank, final prefilter bank) of each air handling unit filter assembly. Do not provide for fan coil units or terminal units. Units shall be complete with pressure fittings, tubing, vent valves, lags, fluid, and the like as required for a complete installation. Acceptable: Dwyer Series 250-AF with pressure range as applicable for filter bank. Not required for fan coil units. Manometers shall be installed in strict accordance with the manufacturer's instructions and in a manner which will not compromise filter access. Provide mounting brackets as required for proper installation. Set red and green signal flags for proper indication of status of the filters involved.

### 3.3 MISCELLANEOUS SUPPORT STEEL AND HARDWARE

- A. Provide as required to provide for adequate support and structural integrity of each filter bank. In no case shall supplementary supports be less than those indicated or recommended by the filter manufacturer in his standard installation instructions.

### 3.4 FILTER ASSEMBLY LOCATIONS

- A. Where scheduled and shown on the drawings.

### 3.5 ORIGINAL AND SPARE FILTER SETS

- A. Provide an original filter set and two (2) spare filter sets for each unit having an air handling equipment filter assembly specified above. Upon initial start-up, each filter assembly shall be provided with a complete original filter set. Prior to or at the time of final test and balance, this original filter set shall be replaced with a complete new spare filter set. However, if at the time of final test and balance there is still useful operating life remaining in the initial filter set (i.e. the filters are still operating within their recommended pressure drop limits for the particular application), then the Contractor (if he is given written approval by the final test and balance agency) may give the spare filter sets to the Owner (at a place of the Owner's selection on the site) in lieu of replacing the original filters with the spare filters.

END OF SECTION

## SECTION 235223 - BOILERS: HOT WATER, CAST IRON, GAS FIRED

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.

#### 1.2 SCOPE

- A. Provide complete factory packaged sectional cast iron hot water boiler-burner assembly(s) where indicated. Boiler shall be completely assembled and fire tested at the factory. Size, capacity and performance shall be as scheduled and indicated.

#### 1.3 RELATION TO OTHER WORK

- A. Coordinate equipment ordering, delivery and placement; utility connections; and the work of all related trades.

#### 1.4 SHOP DRAWINGS

- A. Refer to section entitled "General Mechanical Provisions". Include complete information on: Gas train; burner; operating and safety controls, including combustion safeguards; operating sequence, power requirements; and power, control and interlock wiring diagrams.

#### 1.5 BASIS OF DESIGN

- A. Basis of design is Lochinvar – Copper Fin-2.

#### 1.6 ACCEPTABLE MANUFACTURERS

- A. Cleaver-Brooks, Weil-McClain, H.B. Smith Co. or equivalent.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Basic Features: Ductile cast iron sectional type; complete packaged assembly including pressure vessel and base; forced draft burner; jacket with insulation; all necessary and required controls, fuel train and trim; factory assembled and fire tested.

#### 2.2 PRESSURE VESSEL

- A. Have the following features, characteristics and components:



1. Be constructed in accord with Section IV of the ASME Boiler and Pressure Vessel Code. Each section stamped with ASME "H" symbol.
2. Sections constructed of ductile iron.
3. Pressurized furnace for forced draft venting.
4. Combustion chamber completely surrounded by circulating water.
5. Sections assembled with cast iron push nipples to provide water side sealing. Gas side sealed with ceramic fiber rope gasket. Sections connected with tie bolts and nuts or by tie rods.
6. Mounted on structural steel channel base with provisions for anchoring to a foundation pad.
7. Cleanout openings in front section of boiler for access to flueways.
8. Drain connections.
9. Observation ports for flame inspection.
10. Hot water outlet connection. Hot water return connection. Both flanged.
11. Air elimination tapping.
12. Jacket and insulation: Sheet metal jacket covering not less than 1-inch thick fiberglass blanket attached directly to all jacket panels.

## 2.3 BURNER ASSEMBLY

- A. Burner shall have the following features, characteristics as components:
1. Multiple port type suitable for operation with natural gas.
  2. Operate on LOW-HI-LO-OFF principle.
  3. Gas pilot: Pre-mix type with automatic electric ignition; UV flame detection pilot monitor to prevent primary gas valve from opening until pilot flame is established.
  4. Flame retention stabilizer for proper mix of gas and combustion air.
  5. Blower: Integrally mounted with the burner; directly connected to a flanged type 3450-rpm motor.
  6. Combustion air proving switch to guarantee adequate combustion air.

7. Burner combustion air controlled by hydraulically controlled air damper. Damper positioning switch to allow fixed firing rate into low or high fire position.

## 2.4 TRIM

A. The following shall be included:

1. Low water cutoff.
2. Temperature controls as follows:
  - a. Auto re-set type for burner on-off control.
  - b. Auto re-set type for burner firing rate.
  - c. Manual re-set type for burner cutout on excessive water temperature.
3. Pressure-temperature gage located near outlet.
4. Water relief valves.

## 2.5 PAINTING

A. The entire boiler, base frame and other components shall be properly cleaned primed, and factory painted with a hard-finish enamel.

# PART 3 - EXECUTION

## 3.1 BOILER PLACEMENT

A. The location shall be essentially as shown on the drawings; however, actual placement shall be verified using field measurements and data relating to the equipment approved for actual installation on this project in order to avoid conflict with the structure and work of other equipment.

## 3.2 GAS PIPING

A. Provide as specified in other sections.

## 3.3 WATER PIPING

A. Hot water and makeup and fill piping shall be provided as specified in other sections.

## 3.4 MANUFACTURER'S FIELD SUPERVISION AND STARTUP

A. Include the cost of an authorized representative of the boiler manufacturer who shall personally checkout complete boiler installation; startup and test unit; and calibrate

all unit controls and perform such adjustments as may be required to insure optimum performance and efficiency.

### 3.5 OTHER REQUIREMENTS

- A. Provide all necessary service and operational clearances.
- B. Properly interface with all other related controls (e.g., flow switches, time clocks, pump starters, etc., as applicable) to provide proper system operation.
- C. Properly connect all piping and electrical connections and provide isolating gate valves and unions in hot water supply and return piping to boiler.
- D. Install on concrete housekeeping pad.
- E. Pipe pressure relief valve discharge to nearest floor drain.

END OF SECTION

## SECTION 235719 - HEAT EXCHANGERS: PLATE TYPE

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide complete plate type heat exchanger assemblies of the size, capacity and requirements indicated.

#### 1.2 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions, for related requirements. Refer to other sections of the Division 23 and to all other applicable portions of the drawings and specification.

#### 1.3 CODES AND STANDARDS

- A. Equipment shall be designed, manufactured and tested in accordance with the latest edition and addenda of ASME Boiler and Pressure Vessel Code Section VIII, Division I, or Section III, Class 3.

#### 1.4 SHOP DRAWINGS

- A. Refer to the section entitled, "General Mechanical Provisions".

#### 1.5 BASIS OF DESIGN

- A. Basis of design is similar to Baltimore Aircoil "Ener-Changer".

#### 1.6 MANUFACTURERS

- A. Acceptable manufacturers are: Baltimore Aircoil, Alfa-Laval, Dean Products, Bell & Gossett, or equal.

### PART 2 - GENERAL

#### 2.1 GENERAL

- A. Heat exchanger shall consist of a removable assembly of gasketed plates supported in a frame, fitted with inlet and outlet nozzles or studded ports for each fluid stream.

#### 2.2 FRAME

- A. Shall provide the structural support and pressure containment for the plate pack; consists of fixed cover, movable cover, upper and lower carrying bars, closing bolts and nuts and carrying bar support column.

## 2.3 COVERS

- A. Fixed Cover: Located at primary stationary end of the plate heat exchanger. Shall contain all four service nozzles or studded ports and shall extend to the foundation on which the heat exchanger stands. The fixed cover end shall be supported by either two legs or one leg extending along the entire width of the exchanger. The other end may have one support leg only.
- B. Movable Cover: Shall be supported in a roller bearing hanger from the upper carrying bar along which it can move guided by the lower carrying bar. The movable cover shall provide the other bearing surface and mounting for the opposite end of the closing bolts.

## 2.4 CARRYING BARS

- A. Upper Carrying Bar: Shall be supported horizontally by the fixed cover and the carrying bar support column, to both of which it shall be welded or bolted. A stainless steel Tee section shall be welded to the upper carrying bar to provide the mounting member for the plates of the plate pack.
- B. Lower Carrying Bar: Bar shall be welded or bolted to the stationary cover and the carrying bar support column. It shall be sheathed in stainless steel on those three surfaces in contact with the plates and shall be a guide bar only for the plates.

## 2.5 CARRYING BAR SUPPORT COLUMN

- A. Shall extend to the foundation on which the plate heat exchanger is mounted. With the fixed cover it shall support the carrying bars, the upper of which carries the plate pack. The carrying bar support column with the fixed cover shall transmit the static load of the plate heat exchanger to the foundation.

## 2.6 COMPRESSION BOLTS AND NUTS

- A. Compression bolts and nuts shall bear against the fixed and movable cover to close the plate pack to the dimension established by the number of plates in the plate pack.
- B. Compression bolts lengths shall accommodate provision for future expansion. Washers shall be provided at both ends of compression bolts.

## 2.7 PLATE PACK

- A. Plate pack shall consist of an assembly of gasketed plates which when compressed between the fixed and movable covers forms the vessel. The plates shall separate the hot liquid from the cold liquid and act as the heat transfer surface.

- B. The minimum thickness and design of plates shall be adequate so that each plate can withstand full pressure differential on either side.
- C. Design of plates shall have metal to metal contact between adjacent plates.
- D. Gasket grooves shall be designed to contain gaskets within the grooves, to provide full gasket support, and to prevent over-compression of the gaskets.
- E. Port holes not feeding passes between plates shall be fully gasketed and vented to the atmosphere.
- F. Plates shall be fully supported from the top carrying bar and only guided by the bottom bar with reinforced slots integral with the plate.
- G. Plate and gasket arrangements shall prevent heating and cooling mediums from coming in contact with either the fixed or movable covers.
- H. Each plate shall be pressed from a homogenous piece of sheet metal.
- I. End plates shall be furnished at the fixed and movable cover to provide sealing of the first and last flow channel.

## 2.8 GASKETS

- A. Each heat transfer plate shall be fitted with a gasket which contains and separate the liquids between the plates.
- B. Gaskets shall be compressed to achieve a metal to metal contact between plates during operation.
- C. Relieving grooves shall be provided in the gaskets at those locations where internal seals are used so that, should an internal seal failure take place, it will become immediately evident by visual inspection of the external surface of the exchanger. The relieving grooves shall be located so that no cross contamination of liquids can occur due to internal seal failure without external evidence, as described above.
- D. Each plate with a gasket in place shall undergo a curing operation at a temperature no less than the exchanger normal operating temperature, for a duration of one hour. After curing, all gaskets shall be checked. Deformed gaskets shall be replaced and the curing operation shall be repeated on new gaskets.

## 2.9 NOZZLES

- A. Provide 150-lb ASA rated loose flange type.

## 2.10 OTHER REQUIREMENTS

- A. Plate Design: Unit shall be supplied with a mixed Herringbone Plate Design so that the unit can be optimized with respect to minimum pressure drops and heat transfer surface required for the duty. Mixed plate design shall consist of plated of varying

corrugation configurations, but of the same size, mixed in the plate pack to optimize heat transfer, flow rates, and pressure drop.

- B. Lifting lugs to facilitate handling of exchanger and component shall be provided and designed to withstand the flooded weight of the unit.
- C. Identification: All plates shall be marked with type reference symbol and individually numbered in sequence.
- D. Arrangement: Unit shall be arranged for single pass flow on each side so that all piping connections are located at the fixed end, permitting the heat exchanger to be opened for inspection or cleaning without disturbing the piping. In addition, the inlet and outlet connections for each stream will be located on the same side of the exchanger to facilitate piping. Units shall be designed to be self-draining whenever possible.

### PART 3 - EXECUTION

#### 3.1 GENERAL

- A. Install in accord with manufacturer's recommendations.
- B. Arrange to allow all necessary access for servicing and maintenance.
- C. Provide all necessary support for the assembly.
- D. Coordinate piping connections with flow diagrams and layout shown on Drawing.

END OF SECTION

SECTION 236513 –  
COOLING TOWERS, PACKAGED, INDUCED DRAFT, STAINLESS STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.
- B. This section directly relates in particular to sections (which may or may not be included in this division) which describe the following:
  - 1. Direct Digital Control System.
  - 2. Water treatment systems
  - 3. Chillers, centrifugal
  - 4. Performance Verification.
  - 5. HVAC Pumps.
  - 6. Electrical sections.

1.2 SCOPE

- A. Provide, test and adjust complete package type, vertical discharge, induced draft, double-cross flow cooling tower assemblies of the capacity, operating and electrical characteristics indicated on the drawings as specified herein.

1.3 RELATION TO OTHER WORK

- A. Refer to the section, "General Mechanical Provisions", for related requirements. Refer to other sections of Division 23 and to all other applicable portions of the Drawings and Specifications.

1.4 SHOP DRAWINGS

- A. Refer to the Section entitled "General Mechanical Provisions". Include complete data on: unit dimensions, minimum operating and service clearances, capacities and rating conditions, maximum operating weights, fan and motor horsepower, motor type and wiring arrangements, materials of construction, fan drive, static and dynamic pump head losses, details of piping support at fan casing and all accessories.

1.5 OTHER REQUIREMENTS

- A. Be suitable for installation on top of steel or concrete supports as indicated on Drawings.
- B. Furnished complete with all accessories, appurtenances, and like items as required to provide a complete system which functions as described and implied.



- C. Maximum drift loss not greater than 0.010 % of design condenser water flow rate.

## 1.6 CAPACITY AND RATING CONDITIONS

- A. Tower's thermal performance shall be certified by the Cooling Technology Institute (CTI). Tower performance shall be guaranteed to meet the specified operating conditions when tested by an independent testing agency in accordance with ASME Standard PT-105 or CTI test procedures.
- B. CTI certification notwithstanding, the cooling tower manufacturer shall guarantee that the tower supplied will meet the specified performance conditions when the tower is installed as indicated for this specific project. If, because of a suspected thermal performance deficiency, the Owner chooses to conduct an on-site thermal performance test under the supervision of a qualified, disinterested third party in accordance with CTI or ASME standards during the first year of operation; and if the tower fails to perform within the limits of test tolerance; then the cooling tower manufacturer will pay for the cost of the test and will make such corrections as are appropriate and agreeable to the Owner to compensate for the performance deficiency.
- C. The tower shall be capable of cooling the scheduled water flow rate from the entering conditions given to the leaving conditions given while operating in the scheduled ambient wet bulb conditions.

## 1.7 STRUCTURAL AND WIND LOADING DESIGN CONDITIONS

- A. The tower and all its components shall be designed to withstand a wind load of 30 psf (1.44kPa), as well as a 0.3g seismic load. It shall be designed to withstand shipping and hoisting loads of 2g horizontal and 3g vertical.
- B. The fan deck and hot water basin covers shall be designed for 50 psf (2.42 kPa) live load or a 200 lb. (91 kg) concentrated load.
- C. Handrails, where specified, shall be capable of withstanding a 200 lb. (890 N) concentrated live load in any direction, and shall be designed in accordance with OSHA guidelines.

## 1.8 MANUFACTURER

- A. Products listed in this Section or on the plans are based on a specific manufacturer to establish the desired style, quality and type. Equivalent products, complying with the requirements of this Section and the installation requirements of the plans, by the following manufacturers are acceptable:
  - 1. Marley
  - 2. Baltimore Air Coil

- 3. Evapco
- 4. Protec (FRP - Construction)

## 1.9 WARRANTY

- A. The entire tower, including structure, casing, basins, decking, fan(s), motor(s), and all mechanical drive components (including belts, if used) shall be warranted against failure due to defects in materials and workmanship for a period of five (5) years from the date of shipment to the job. Towers not covered by a warranty of this scope will not be accepted.

## PART 2 – PRODUCTS

### 2.1 GENERAL CONSTRUCTION

- A. Fireproof design. The tower shall include all design and material modifications necessary to meet the fire rating requirements of Factory Mutual. The product proposed shall be listed in the FM Approval Guide, latest edition.
- B. Except where otherwise specified, all components of the cooling tower shall be fabricated of heavy-gauge, series 300 stainless steel or (FRP). The tower shall be capable of withstanding water having a chloride content (NaCl) up to 750 ppm; a sulfate content (SO<sub>4</sub>) up to 1200 ppm; a calcium content (CaCO<sub>3</sub>) up to 800 ppm; silica (SiO<sub>2</sub>) up to 150 ppm; and design hot water temperatures up to 125°F (51.7°C). The circulating water shall contain no oil, grease, fatty acids, or organic solvents.

### 2.2 FRAMEWORK

- A. Heavy gauge series 300 stainless steel.

### 2.3 CASING AND FAN DECK

- A. Heavy-gauge series 300 stainless steel capable of withstanding the loads previously described.

### 2.4 FAN GUARD

- A. Conical, non-sagging, removable fan guard at top of each fan cylinder.
- B. Fabricated of welded 5/16" (8mm) and 7 gauge rods, and hot dip galvanized after fabrication

### 2.5 LOUVERS

- A. Non-sagging design and construction. Either same material as casing, or thermoformed to be integral with the fill sheets.
- B. Air inlet faces of the tower shall be free of water splash-out.

## 2.6 COLD WATER BASIN

- A. Heavy gauge series 300 stainless steel. Self cleaning with depressed center section, cleanout and drain fittings. Basin and tower shall be completely self-supporting when resting on two support beams.
- B. Interconnect basins of adjacent cells with stainless steel flumes and slide weir gates for flow and equalization between cells for towers of more than one cell. Interconnecting flume between cells shall be equipped with removable cover plate to permit the shutdown of one cell for maintenance purposes, or to permit independent cell operation.
- C. Provide the number and type of suction connections required to accommodate the outflow piping system indicated for this project.
- D. Provide stainless steel debris screens for each suction connection.
- E. Provide a 4-inch minimum diameter PVC pipe overflow in each tower cell.
- F. Include depressed center section into which accumulated silt can be flushed and overflow standpipes shall be removable to permit flush-out cleaning of the basin. Basin floor adjacent to depressed section shall slope toward depressed section to prevent silt build-up under fill area.

## 2.7 ACCESS TO BASIN AND PLENUM AREA

- A. Access Doors: Provide a stainless steel access door not less than 30" (762mm) wide and not less than 33" (838mm) high at both endwalls for entry into the cold water basin and fan plenum area. Operable from inside as well as outside the tower.
- B. Plenum Walkway: Provide galvanized steel bar grating walkway extending from one endwall access door to the other endwall. Support walkway by stainless steel framework. Top of grating shall be at or above cold water basin overflow level.

## 2.8 DISTRIBUTION SYSTEM

- A. All components of the hot water distribution system shall be stainless steel except for distribution nozzles.
- B. Open gravity type using stainless steel distribution pans. Removable, interchangeable polypropylene nozzles installed in the floor of these basins shall provide full coverage of the fill by gravity flow
- C. Removable stainless steel distribution pan covers.

- D. Each basin shall include an inlet hole and bolt circle to accept a 125# flange connection per ANSI B16.1.
- E. Heavy-duty flow-regulator valves at hot water inlet connections to each distribution pan section. Valves shall be disc type, with cast iron bodies, stainless steel operating stems, with locking handle to maintain valve setting in any position. Valves shall be right angle configuration, precluding the need for inlet elbows.

## 2.9 FLOAT OPERATED MAKE-UP VALVE

- A. Provide a factory installed, float operated, mechanical makeup valve for each basin of each tower cell.

## 2.10 FILL AND DRIFT ELIMINATORS

- A. Fill: Non-corrosive; non-ferrous; replaceable; vertical polyvinyl chloride (PVC) sheets.
- B. Drift eliminators: PVC; sag-proof supports. Limit drift losses

## 2.11 FANS AND DRIVES

- A. The complete fan, motor and drive assembly for each cell shall be supported by a rigid, welded, stainless steel structural support that resists misalignment between the motor and the gear reducer.
- B. Fans(s):
  - 1. Propeller type, axial flow.
  - 2. Blades: Heavy duty aluminum alloy with electro-galvanized hubs. Individually adjustable blades.
- C. Fan Drive: Parallel shaft or right angle gear-reducer or multi-groove single belt band type. Right angle, industrial duty, oil lubricated, geared speed reducer requiring oil change no often than every five years of operation.
- D. Bearings: Equipped with external lubrication fittings. Provide oil level sight glass for gear drive and protection for drive and fan in accordance with OSHA standards. Minimum L10 life of 40,000 hours.
- E. Sound Attenuation: Provide with low noise fan.

## 2.12 MOTORS

- A. Totally enclosed fan cooled; 1.15 service factor; variable torque, 1800 RPM maximum; specially insulated for cooling tower duty.
- B. Motor shall operate in shaft-horizontal position.

- C. Be rated for operation with variable speed drive or be provided as a 2-speed motor, whichever is indicated on drawings and/or in control sequence. Nameplate horsepower shall not be exceeded at design operation.

## 2.13 HARDWARE AND FINISH

- A. Be of non-corrosive materials.
- B. Bolts, Nuts and Washers: Compatible electrolytically with the metals being connected or joined.
- C. All other steel not required to be stainless steel shall be hot dipped galvanized with minimum coating of 2.25 ounces per square foot.

## 2.14 OTHER ITEMS

- A. Access Ladders: Aluminum or galvanized steel. Comply with OSHA standards.
- B. Handrail: Around upper perimeter of tower. Comply with OSHA standards.
- C. Vibration Sensor: Provide a vibration sensor (adjustable for sensitivity) designed to stop the cooling tower fan due to any excess vibration of the; fan, gear drive or motor. Provide auxiliary alarm contact.
- D. Oil Level Switch: Provide an oil level switch to stop the tower fan due to low oil level in gear reducer.

## 2.15 OPENINGS IN CASING FOR MAKE-UP WATER PIPING

- A. Factory provided openings to facilitate make-up water piping configurations indicated on the drawings, and adequate in size to pass insulated pipe. Factory reinforcing around opening if required.

## 2.16 PIPING SUPPORT

- A. Supply piping to header shall be supported from cooling tower casing.

# PART 3 – EXECUTION

## 3.1 COORDINATION

- A. Coordinate all matters (including, but not limited to, access, mounting height; fluid and electrical conduit connections and other similar items) related to the installation and proper function of the entire cooling tower assembly.

### 3.2 TESTS

- A. Perform all tests necessary to establish the specified performance of the cooling tower assembly.

### 3.3 DISCHARGE CONE HEIGHT

- A. Install top of discharge cone to be level with top of surrounding screen wall if wall is applicable.

### 3.4 TOWER PLACEMENT

- A. The tower location shall be essentially as shown on drawings; however, actual placement shall be verified using field measurements and data relating to the units approved for actual installation on this project. Install the tower on the supports furnished as work of another Section.

### 3.5 STARTERS AND WIRING

- A. Be compatible with variable speed type or two speed type fan drive motors, depending on method of control described in Division 23 section describing DDC control system for HVAC systems. All wiring shall comply with Electrical Division of these Specifications.

### 3.6 PIPING

- A. Piping shall be essentially as shown on the drawings. Assemble, mount and pipe such miscellaneous accessory items as make-up and float valves, drain valves and piping, and hose bib for flushing and cleaning towers. Provide adequate support hardware to support supply branch piping from cooling tower casing.

### 3.7 ERECTION

- A. Provide all plant, materials, equipment and labor to perform any field erection and assembly of the tower and its accessories.

### 3.8 CLEANING

- A. After assembly and prior to filling tower or condenser water system the tower shall be thoroughly cleaned and flushed to remove all dirt and debris.

### 3.9 CHEMICAL TREATMENT SYSTEM

- A. Coordinate with the water treatment system specified. Provide all interfacing connections (pipe, valves, drains and similar items).

END OF SECTION

## SECTION 238131 - DUCTLESS SPLIT-SYSTEM AIR-CONDITIONING UNITS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes ductless split-system air-conditioning and heat pump units consisting of separate evaporator-fan and compressor-condenser components. Units are designed for fully exposed or partially concealed mounting, and may be connected to small branch and outside air ducts.

#### 1.2 SUBMITTALS

- A. Product Data: For each unit indicated. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Operation and maintenance data.

#### 1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.4 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within the following specified number of years from date of Substantial Completion:
  - 1. Entire unit: 1 year parts and labor.
  - 2. Compressor: 5 years parts.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Basis of design: Enviro Master International Corp. (EMI)
  - 2. Carrier Air Conditioning; Div. of Carrier Corp.
  - 3. Mitsubishi Electronics America, Inc.; HVAC Division.
  - 4. Sanyo Fisher (U.S.A.) Corp.
  - 5. Daikin.



## 2.2 EVAPORATOR-FAN UNIT

- A. Exposed, Wall Mounted Unit Cabinet: Fabricated of cold roll steel with structural stiffness.
  - 1. Insulation: Faced, glass-fiber duct liner.
  - 2. Drain Pans: Galvanized steel, with connection for drain; insulated.
  - 3. Intake Grille: High impact polystyrene air inlet panel.
  - 4. Discharge Grille: High temp noryl.
  - 5. Evaporator Fan: Tangential type.
- B. Partially Concealed Ceiling Mounted Unit Cabinet:
  - 1. Chasis: Galvanized steel.
  - 2. Fascia: High impact polystyrene.
  - 3. Drain Pans: Galvanized steel, with connection for drain; insulated.
  - 4. Evaporator Fan: Backward curved centrifugal.
- C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.
- D. Electric Coil: Helical, nickel-chrome, electric-resistance heating elements with refractory ceramic support bushings; automatic-reset thermal cutout; built-in magnetic contactors; manual-reset thermal cutout; airflow proving device; and one-time fuses in terminal box for overcurrent protection.
- E. Fan Motor: Multispeed.
- F. Filters: Permanent, electrostatic, cleanable.
- G. Condensate Pump: Where scheduled.

## 2.3 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

- A. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- B. Compressor: Hermetically sealed reciprocating or scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
- C. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.
- D. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

- E. Fan: Aluminum-propeller type, directly connected to motor.
- F. Motor: Permanently lubricated, with integral thermal-overload protection.
- G. Low Ambient Kit: Permits operation down to 45 deg F.
- H. Mounting Base: Polyethylene.
- I. Where multizone units are specified, each compressor and circuit shall be sized properly for each evaporator.

## 2.4 ACCESSORIES

- A. Thermostat: Provide with optional remote. Low voltage with subbase to control compressor and evaporator fan.
- B. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
- C. Infrared Control: Provide with factory infrared controls and remote operator.
- D. Time Delay: Provide with short cycle time delay.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- B. Install ground-mounted, compressor-condenser components on 4-inch- thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.
- C. Install ground-mounted, compressor-condenser components on polyethylene mounting base.
- D. Install roof-mounted, compressor-condenser components on equipment supports equal to Pate ER. Anchor units to supports with removable, cadmium-plated fasteners.
- E. Install compressor-condenser components on restrained, spring isolators with a minimum static deflection of 1 inch.

### 3.2 CONNECTIONS

- A. Connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.
- B. Connect supply and return water coil with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
- C. Connect supply and return condenser connections with shutoff-duty valve and union or flange on the supply connection and with throttling-duty valve and union or flange on the return connection.
- D. Install piping adjacent to unit to allow service and maintenance.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.
- B. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new components, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

## SECTION 238144 - AIR CONDITIONING UNITS, PACKAGED ROOFTOP

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide packaged rooftop air conditioners where indicated on the drawings. Unit capacities and operating conditions shall be as scheduled on the drawings.

#### 1.2 RELATION TO OTHER WORK

- A. Coordinate shop drawings; equipment ordering, delivery and placement; structural framing; roof construction; roofing; utility connections. Refer to the Section entitled "General Provisions".

#### 1.3 SHOP DRAWINGS

- A. Refer to the Section entitled "General Provisions". Include complete data on roof curbs; duct opening requirements; equipment weights; power and control wiring (both factory and field); operating and safety controls; capacities and rating conditions; and equipment sound power levels in each octave band.

#### 1.4 WARRANTY

- A. Include the cost of one year's warranty on entire system plus an additional four years warranty on refrigerant system and all components thereof. The first year's warranty shall comply with the standard warranty (guaranty) provisions of these specifications. The additional four year warranty shall include parts, refrigerant and oil, exclusive of labor.

#### 1.5 MANUFACTURER

- A. Design Basis: Units used as a design basis are Valent –VRP.
- B. Acceptable Manufacturers: AAON, Greenheck, Desert Aire.

### PART 2 - PRODUCTS

#### 2.1 FRAME

- A. Unit shall be completely factory assembled with all components mounted on a one piece unitized frame. Frame shall be constructed of extruded aluminum or welded steel. Frame shall incorporate lifting lugs for purposes of rigging and setting the unit in place.

#### 2.2 CASING

- A. Unit casing shall be not less than 14 gauge zinc coated steel, phosphatized, epoxy primed, and finished with enamel. Casing roof shall utilize one piece construction with all seams filled with sealant. Access shall be provided by means of access panels furnished in sufficient number and size to enable ready access to all controls, fans, coils, filters, compressors, refrigerant system accessories, and service valves. Access panels shall be gasketed neoprene seals.

## 2.3 REFRIGERANT COILS

- A. Refrigerant coils shall be constructed of seamless copper tubes with aluminum heat transfer fins mechanically bonded thereto. Condenser coils shall be tested at not less than 400 psig and proved tight. Evaporator coils shall be tested at not less than 300 psig and proved tight.
- B. Units scheduled as having two compressors must be provided with two compressors; single compressor units are not acceptable unless scheduled as such.

## 2.4 ELECTRIC HEATER

- A. Provide electric resistance heating coils, of the capacities scheduled, as integral factory mounted and wired equipment. Heating coils shall be of heavy duty nickel chromium wire and incorporated manual and auto reset high limit protection devices and air flow interlock devices. Heaters shall be UL labeled. Heaters shall be SCR controlled.

## 2.5 FANS

- A. Supply Air Fans: Supply air fans shall be double width, double inlet forward curved blade type and shall be both statically and dynamically balanced. Fans shall be of the belt type. Drives shall conform with the Section entitled "General Provisions".
- B. Condenser Fans: Shall be propeller type, direct drive, statically and dynamically balanced and protected with metal guards on discharge side.

## 2.6 FILTERS

- A. Two inch (2") thick throwaway filters which shall filter both return and outside air handled by unit. Filter media shall be non-organic long fiber mineral glass type with viscous coating and shall be UL Class 2. Filter average dust spot efficiency atmospheric shall be not less than twenty-five percent (25%). Filter face velocity shall not exceed 500 fpm.

## 2.7 COMPRESSORS

- A. Unit compressor(s) may be of the hermetic or semi-hermetic type.

## 2.8 REFRIGERANT CIRCUIT ACCESSORIES

- A. The following refrigerant accessories shall be included: Suction accumulator; backseating compressor suction and discharge valves with gauge ports on serviceable hermetics; high and low pressure service gauge ports and valves; filter drier; sight glass and moisture indicator; thermostatic expansion valves; and crankcase heater. Where units have multiple compressors, the above shall apply to each compressor refrigerant circuit.

## 2.9 INSULATION

- A. All casing panels and all interior surfaces of exterior casing members in contact with air stream shall be insulated with not less than one inch (1") expanded foam. All unit insulation and adhesives shall comply with the requirements of NFPA 90A as to flame spread and smoke developed ratings.

## 2.10 ROOF CURB

- A. Unit shall be furnished complete with National Roofing Contractor's Association approved roof curb constructed of not less than 14 gauge zinc coated steel with gasketed supply and return air openings. Curb height shall be a minimum of twelve inches (12").

## 2.11 UTILITY CONNECTIONS

- A. Utility connection openings may be provided within the roof curb enclosure, or on the exterior of the unit provided a good water seal is provided to prevent leakage within the unit.

## 2.12 CONTROLS

- A. General: Units shall be furnished and installed complete with all system operating and safety controls specified herein and as otherwise required for a complete and operable system. Controls shall be of the electric and electronic type. Unit controls shall operate at 115V AC and all remote controls shall be low voltage (less than 50V AC).
- B. Refrigerant Controls: Refrigerant controls shall include short cycle protection; high pressure cutout; low pressure cutout; and oil pressure failure protection switch (on serviceable hermetics).
- C. Room Controls: Each unit shall be provided with an individual space control capable of matching system heat input on heat removal to space heat loss or heat gain sufficiently close to maintain a space temperature within plus or minus two (2) degrees of thermostat setpoint.

- D. Thermostat: Provide for each unit a remote thermostat located in the space served by the unit. Thermostat shall have the following minimum control features:
1. System heat-off-cool selector switch.
  2. Fan on-auto switch.
  3. Power and filter status indicated lights.
- E. Automatic Time Switch: Furnish and install an electric time switch with electrically would synchronous carryover feature to start and stop the unit with system selector switch in the "auto" position. Clock shall be capable of starting and stopping unit at different times on different days and of skipping days. Provide time clock override switch for each unit.

## PART 3 - EXECUTION

### 3.1 PLACEMENT AND MOUNTING

- A. Unit location shall be essentially as shown on drawings. However, actual placement of the roof curb shall be verified using field measurements and data relating to the equipment approved for actual installation on this project. The roof decking, roof slab, and roof insulation shall be continuous throughout the area enclosed by the curb with the exception of the actual supply and return duct penetrations. Duct penetrations shall be continuously sealed using a non-hardening sealant.

### 3.2 WIRING

- A. All control, and interlock wiring shall be run in conduit and shall be performed as work of Division 23.

### 3.3 DUCT CONNECTIONS

- A. Supply and return ducts shall be connected to their respective unit duct collars using flexible connectors. These connectors shall be installed properly so that they are not in tension and are aligned with their respective ducts.

### 3.4 MANUFACTURER'S FIELD SUPERVISION

- A. Provide the services of an authorized representative of the equipment manufacturer who shall personally supervise the following: check out of all field wiring; unit start up; and unit test and balance including control calibration.

### 3.5 TESTING AND BALANCING

A. Refer to Section describing test and balance.

END OF SECTION



## SECTION 238146 - AIR CONDITIONING UNITS: HEAT PUMP, WATER COOLED

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide packaged water cooled heat pumps where indicated on the drawings. Unit capacities and operating conditions shall be as scheduled on the drawings.

#### 1.2 RELATION TO OTHER WORK

- A. Coordinate shop drawings; equipment ordering, delivery and placement; structural framing; roof construction; roofing; utility connections. Refer to the Section entitled "General Mechanical Provisions".

#### 1.3 SHOP DRAWINGS

- A. Refer to the Section entitled "General Mechanical Provisions". Include complete data on: equipment weights; power and control wiring (both factory and field); operating and safety controls; capacities and rating conditions; and equipment sound power levels in each octave band.

#### 1.4 WARRANTY

- A. Include one year warranty on entire system plus an additional four years warranty on refrigerant system and all components thereof. The first year's warranty shall comply with the standard warranty (guaranty) provisions of these specifications. The additional four year warranty shall include parts, refrigerant and oil, exclusive of labor.

#### 1.5 DESIGN BASIS

- A. Basis of design is similar to Climate Master 814 Series Water-to-Air Horizontal Heat Pumps.

#### 1.6 MANUFACTURER

- A. Acceptable manufacturers are: Climate Master, Florida Heat Pump, Lennox, Commandaire, American Air Filter, or equal.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Units shall be water-cooled packaged heat pumps designed for horizontal ceiling mounting with ducted connections and shall be factory piped and internally wired.

- B. Be factory wired for single point power connection.

## 2.2 CABINET

- A. Constructed of heavy gage galvanized steel. Interior side insulated with not less than 1/2-inch thick fiberglass.
- B. Insulated partition between blower and compression compartments to minimize sound transmission.
- C. Water connections shall be female pipe threaded and mounted flush with cabinet exterior.
- D. Discharge duct collar.
- E. Return air filter rack with 1-inch thick throwaway filter.
- F. Support points to allow suspended installation of unit in conjunction with any other vibration isolation which may be required.

## 2.3 ACCESS

- A. Service panels which are easily removable for access to all components.
- B. Units over 14,000-btuh capacity shall have sufficient service access to replace compressor without removing entire unit.

## 2.4 COMPRESSORS AND REFRIGERANT CIRCUIT

- A. General: Hermetic type, internally sprung and externally isolate to minimize sound transmission.
- B. Airside heat exchanger: Be a finned tube coil with aluminum fins and copper tubes for refrigerant-to-air heat transfer.
- C. Waterside heat exchanger: Be a coaxial tube-in-tube exchanger with copper inner water tube and steel refrigerant outer tube.
- D. Reversing valve: Four way solenoid activated valve.
- E. Refrigerant metering device: Capillary tubes or expansion valve selected for optimum performance.
- F. High and low pressure safety cutouts.
- G. Interconnecting tubing: All copper.

H. All units shall be provided with factory installed compressor blankets for sound attenuation.

I. Access fittings factory installed on high and low side refrigerant lines for field service.

J. Over-current and over-heat protection for compressor motor.

## 2.5 FAN ASSEMBLY

A. Centrifugal blowers driven by single phase PSC permanently lubricated motors.

B. Drive: Either direct or belt drive as appropriate for the individual blower capacity. Direct drive motors shall have multi-speed taps.

## 2.6 CONTROLS

A. General: 24-volt controls.

B. Programming relay: Provide factory mounted relay that will accept a 24 volt or 115-volt signal from a central time clock to activate or deactivate the unit. Provide this relay on all units that do not serve individual apartments.

C. Remote thermostat: Manual change-over type with OFF-HEAT-COOL selector switch and AUTO-ON fan switch.

# PART 3 - EXECUTION

## 3.1 GENERAL

A. Install in accord with manufacturer's recommendations.

B. Locate and place essentially as shown on Drawings. Make minor adjustments as necessary to accommodate structure, access, piping and electrical connections, and related work.

## 3.2 PIPING

A. Make all necessary piping connections including closed loop water system connections and condensate and condensate drain piping.

B. Provide all isolation valves as indicated.

## 3.3 DUCTWORK

A. Connect all ductwork generally as indicated.

## 3.4 VIBRATION ISOLATION

A. Provide vibration isolation equipment as specified elsewhere in this Division 23.

3.5 ACCESS

- A. Install to allow necessary access to all components which may require service and maintenance.

3.6 ELECTRICAL AND CONTROL WORK

- A. Coordinate and provide all electrical and control work so that each unit functions as intended and described.

3.7 TEST AND BALANCE

- A. Adjust all water and air flow quantities as needed for proper operation.

END OF SECTION

## SECTION 260080 – TESTS AND PERFORMANCE VERIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

#### 1.2 DESCRIPTION

- A. Time: Perform verification work as required to show that the System is operating correctly in accordance with contract documents and manufacturers literature. All verification shall be done after 3-day full operational period.
- B. Submission: Submit check out memos and completed testing results of all systems, cable, equipment, devices, etc., for acceptance prior to being energized or utilized.

#### 1.3 QUALITY ASSURANCE

- A. Compliance: Testing shall comply to the following standards;
  - 1. NEMA
  - 2. ASTM
  - 3. NETA
  - 4. ANSI C2
  - 5. ICEA
  - 6. NFPA

### PART 2 - TESTS

#### 2.1 EQUIPMENT

- A. Instruments: Supply all instruments required to read and record data. Calibration date shall be submitted on test reports. All instruments shall be certified per NETA standards.
- B. Adjustments: Adjust system to operate at the required performance levels and within all tolerances as required by NETA Standards.

#### 2.2 APPLICATIONS

- A. Switchboards, Panelboards and Mechanical Equipment Feeders: After feeders are in place, but before being connected to devices and equipment, test for shorts, opens, and for intentional and unintentional grounds.
- B. Ratings 600 Volts or Less: Cables 600 volts or less in size #1/0 AWG and larger shall be meggered using an industry approved "megger" with 500 internal generating voltage. Readings shall be recorded and submitted to the Engineer, for acceptance prior to energizing same. Submit 5 copies of tabulated megger test values for all cables.

## 2.3 GROUNDS

- A. Electrode Ground: The resistance of electrodes (main service) shall not exceed 10 ohms and shall be measured by The Contractor before equipment is placed in operation. Testing shall be performed on all grounding electrode installations. Testing shall be 3 point method in accordance with IEEE Standard 81. Submit all ground test readings to the Engineer in tabulated format at substantial completion.

## PART 3 - EXECUTION

### 3.1 SUBMITTALS

- A. Cable Test Report: Submit Cable Test Report in Triplicate.
- B. Check Out Memos: Complete all information on forms at the end of this specification, project information, and certificate of completed demonstration memo. Submit data for examination and acceptance prior to final inspection request.
- C. Tabulated Data: Submit data on 8-1/2 x 11 inch sheets with names of the personnel who performed the test.
- D. Final: Submit accepted memos before a request for final inspection.

### 3.2 QUANTITIES

- A. Quantity: Submit 5 copies of the check out memo on each major item of equipment. Insert accepted memos in each brochure with the performance verification information and submittal data.

END OF SECTION 26 00 80

TABULATED DATA

VOLTAGE AND AMPERAGE READINGS

SWITCHGEAR OR PANELBOARD

FULL LOAD AMPERAGE READINGS:

DATE

TIME

PHASE A.

B.

C.

N.

FULL LOAD VOLTAGE READINGS:

DATE

TIME

PHASE A TO N \_\_\_\_\_ A TO B

B TO N \_\_\_\_\_ A TO C

C TO N \_\_\_\_\_ B TO C

NO LOAD VOLTAGE READINGS

DATE

TIME

PHASE A TO N \_\_\_\_\_ A TO B

B TO N \_\_\_\_\_ A TO C

C TO N \_\_\_\_\_ B TO C

\_\_\_\_\_ ENGINEERS REPRESENTATIVE

\_\_\_\_\_ CONTRACTORS REPRESENTATIVE

## SECTION 260500 – BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. Basic Requirements: The Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. General Provisions: Provide all labor, materials, equipment, and incidentals required to make ready for use complete electrical systems as specified herein and shown on the drawings.
- C. Provide and Install: The word "provide" where used on the Drawings or in the Specifications shall mean "furnish, install, mount, connect, test, complete, and make ready for operation". The word "install" where used on the Drawings or in the Specifications shall mean "mount, connect, test, complete, and make ready for operation". Perform work required by, and in accordance with, the Contract Documents.
- D. Installation: Provide and place in satisfactory condition, ready for proper operation, raceways, wires, cables, and other material needed for all complete electrical systems required by the Contract Documents. Additional raceways and wiring shall be provided to complete the installation of the specific equipment provided. Include auxiliaries and accessories for complete and properly operating systems. Provide electrical systems and accessories to comply with the NEC, state and local codes and ordinances. It is the intent of these Specifications that the electrical systems be suitable in every way for the use intended. Material and work which is incidental to the work of this Contract shall be provided at no additional cost to the Contract.
- E. Field Connections: Provide field connections to remote equipment and control panels provided under other Divisions of these Specifications. Provide raceway, wire, and interconnections between equipment, transmitters, local indicators, and receivers. Provide 120V and low voltage surge protection equipment in accordance with Section 264313 at equipment as required. Install field connections to "packaged" equipment provided under other Divisions of these Specifications.

#### 1.2 SCOPE OF WORK

- A. General: Provide labor, materials, permits, inspections and re-inspection fees, tools, equipment, transportation, insurance, temporary protection, temporary power and lighting, supervision and incidental items essential for proper installation and operation of the Electrical systems indicated in the Contract Documents. Provide materials not specifically mentioned or indicated but which are usually provided or are essential for proper installation and operation of the Electrical systems indicated in the contract documents.
- B. Notices: Give notices, file Plans, pay fees, and obtain permits and approvals from authorities having jurisdiction. Include all fees in the Bid Price.



### 1.3 INTERPRETATION OF DRAWINGS

- A. General: The Drawings are diagrammatic and are not intended to show exact locations of Raceway runs, outlet boxes, junction boxes, pull boxes, etc. The locations of equipment, appliances, fixtures, Raceways, outlets, boxes and similar devices shown on the Drawings are approximate only. Exact locations shall be determined and coordinated in the field. The right is reserved to change, without additional cost, the location of any outlet within the same room or general area before it is permanently installed. Obtain all information relevant to the placing of electrical work and in case of interference with other work, proceed as directed by the Architect.
- B. Discrepancies: Notify the Architect of any discrepancies found during construction of the project. The Architect will provide written instructions as to how to proceed with that portion of work. If a conflict exists between the Contract Documents and an applicable code or standard, the most stringent requirement shall apply.
- C. Wiring: Each three-phase circuit shall be run in a separate Raceway unless otherwise shown on the Drawings. Unless otherwise accepted by the Architect, Raceway shall not be installed exposed. Where circuits are shown as "home-runs" all necessary fittings, supports, and boxes shall be provided for a complete raceway installation.
- D. Layout: Circuit layouts are not intended to show the number of fittings, or other installation details. Connections to equipment shall be made as required, and in accordance with the accepted shop and manufacturer's setting drawings.
- E. Coordination: Coordinate final equipment locations with drawings or other disciplines. Layout before installation so that all trades may install equipment in available space. Provide coordination as required for installation in a neat and workmanlike manner.

### 1.4 EQUIPMENT SIZE AND HANDLING

- A. Coordination: Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, ship the equipment in sections of specific sizes to permit the passing through the necessary areas within the structure.
- B. Handling: Equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer shall be required to brace the equipment suitably, to insure that the tilting does not impair the functional integrity of the equipment.

### 1.5 RECORD DRAWINGS

- A. Production: The Contractor shall provide two (2) sets of black or blue line on white drawings to maintain and submit record "As-Built Documents". Label each sheet of the Record Document set with "Project Record Documents" with company name of the installing contractor in stamped or printed letters. One set shall be maintained at the site and at all times be accurate, clear, and complete. These drawings shall be available at all times to the Architect's field representatives.

- B. Recording: Record information concurrent with construction progress. Make entries within 24 hours upon receipt of information. The "As-Built" drawings shall accurately reflect installed electrical work specified or shown on the Contract Documents.
- C. Completion: At the completion of the Work, transfer changes with a colored pencil onto the second set and submit to the Architect. The "As-Built" drawings shall be made available to the Architect to make the substantial completion punch list.
- D. Final: Upon Contractor's completion of the Engineer's final punch list, transfer all "As-Built" conditions and all requirements by the Engineer to a reproducible set of drawings and CAD files. Submit drawings and CAD disks for review and acceptance. The Contractor shall provide updated disks which include final As-Built conditions.

## 1.6 ABBREVIATIONS

- A. Abbreviations: The following abbreviations or initials may be used:

A/C	Air Conditioning
AC	Alternating Current
ABV CLG	Above Ceiling
ADA	Americans with Disabilities Act
AF	Ampere Frame
AFF	Above Finished Floor
AFG	Above Finished Grade
AHU	Air Handler Unit
AIC	Amps Interrupting Capacity
AL	Aluminum
AMP	Ampere
ANSI	American National Standards Institute
ASA	American Standards Association
AT	Ampere Trip
ATS	Automatic Transfer Switch
AUX	Auxiliary
AWG	American Wire Gauge
BC	Bare Copper
BIL	Basic Impulse Level
BMS	Building Management System
BRKR or BKR	Breaker
CAB	Cabinet
C	Conduit or Raceway
CB	Circuit Breaker
CBM	Certified Ballast Manufacturers
CCTV	Closed Circuit Television
CKT	Circuit
CLEC	Clock Equipment Cabinet
CLG	Ceiling
CO	Conduit or Raceway Only
COAX	Coaxial Cable
COND	Conductor
CONN	Connection
CPU	Central Processing Unit
CRT	Cathode Ray Terminal (Video display terminal)

CT	Current Transformer
CU	Copper
CW	Cold Water
DC	Direct Current
DDC	Direct Digital Control
DEG	Degree
DISC	Disconnect
DO	Draw Out
DN	Down
DPST	Double Pole Single Throw
EMT	Electrical Metallic Tubing
EO	Electrically Operated
EOL	End of Line Resistor
EWC	Electric Water Cooler
FAAP	Fire Alarm Annunciator Panel
FACP	Fire Alarm Control Panel
FCU	Fan Coil Unit
FLA	Full Load Amperes
FM	Factory Mutual
GF	Ground Fault
GFCI	Ground Fault Circuits Interrupter
GND	Ground
HOA	Hand-Off-Automatic
HORIZ	Horizontal
HP	Horsepower
IC	Intercom
ICU	Intensive Care Unit
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IMC	Intermediate Metallic Raceway
IN	Inches
IT	Instantaneous Trip
IPCEA	Insulated Power Cable Engineers Association
JB	Junction Box
KCMIL	Thousand Circular Mills
KV	Kilovolt
KVA	Kilo-Volt-Amps
KW	Kilowatts
LBS	Pounds
LED	Light Emitting Diode
LT	Light
LTD	Long Time Delay
LTT	Long Time Trip
LTG	Lighting
MAX	Maximum
MCB	Main Circuit Breaker
MCC	Motor Control Center
MCP	Motor Circuit Protector
MIC	Microphone
MIN	Minimum
MLO	Main Lugs Only
MTD	Mounted
MTG	Mounting

MUX	Multiplex (Transponder) Panel
MVA	Mega Volt Amps
N	Neutral
NC	Normally Closed
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIC	Not in Contract
NF	Non Fused
NL	Non Linear
NO	Number or Normally Open
#	Number
Ø	Phase
OL	Overload
OSHA	Occupational Safety and Health Administration
P	Pole
PB	Pullbox
PIV	Post Indicator Valve
PNL	Panel
PR	Pair
PWR	Power
PF	Power Factor
PRI	Primary
PT	Potential Transformer
PVC	Polyvinylchloride
REF	Refrigerator
RGC or GRC	Rigid Galvanized Raceway
RMS	Root-Mean-Square
RPM	Revolutions Per Minute
RECPT	Receptacle
SCA	Short Circuit Amps
SD	Smoke Detector
SEC	Secondary
S/N	Solid Neutral
SPKR	Speaker
SPST	Single Pole Single Throw
SST	Solid State Trip
ST	Short Time Trip
STD	Short Time Delay
SW	Switch
SWGR	Switchgear
SWBD	Switchboard
TEL	Telephone
TTB	Telephone Terminal Board
TTC	Telephone Terminal Cabinet
TVEC	Television Equipment Cabinet
TYP	Typical
UL	Underwriters Laboratories
UON	Unless Otherwise Noted
V	Volt
VFD	Variable Frequency Drive
VSD	Variable Speed Drive

W	Wire
WP	Weatherproof
XFMR	Transformer

## 1.7 CODES, FEES, AND STANDARDS

- A. Application: The codes, standards and practices listed herein generally apply to the entire project and specification sections. Other codes, standards or practices that are more specific will be referenced within a particular specification.
- B. Requirements: All materials and types of construction covered in the specifications will be required to meet or exceed applicable standards of manufacturer, testing, performance, and installation according to the requirements of UL, ANSI, NEMA, IEEE, and NEC referenced documents where indicated and the manufacturer's recommended practices. Requirements indicated on the contract documents that exceed but are not contrary to governing codes shall be followed.
- C. Compliance and Certification: The installation shall comply with the governing state and local codes or ordinances. The completed electrical installation shall be inspected and certified by applicable agencies that it is in compliance with codes.
- D. Applicability: The codes and standards and practices listed herein, and their respective dates are furnished as the minimum latest requirements.
  - 1. State of Florida
  - 2. Hillsborough County
  - 3. City of Tampa
  - 4. Hillsborough County Housing Authority
  - 5. Florida Housing Authority.
- E. Utility Company: Comply with latest utility company regulations.
- F. State Statutes: Florida Statutes
  - 1. 4A3, The State Fire Prevention Code
  - 2. 4A47, The Uniform Fire Safety Standards for Elevators.
- G. Building Code: Standard Building Code.
- H. Standards: American Society of Mechanical Engineers
  - 1. ASME-A17.1 Elevator Code, plus Interpretations to Date.
- I. Florida Americans with Disabilities Accessibility Implementation Act (October 1, 1993) as described in Florida Accessibility Code for Building Construction, Department of Community Affairs (October 1997).
- J. Manuals: Accessibility Requirements Manual Florida Department of Community Affairs.

- K. Labels: Materials and equipment shall be new and free of defects, and shall be U.L. listed, bear the U.L. label or be labeled or listed with an approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available or desired for certain types of equipment, test data shall be submitted to validate that equipment meets or exceeds available standards.
- L. NFPA: Latest edition of the following National Fire Protection Association (NFPA) Standards:
- |          |                                                                         |
|----------|-------------------------------------------------------------------------|
| NFPA-13  | Installation Of Sprinkler Systems.                                      |
| NFPA-37  | Installation And Use Of Stationary Combustion Engines And Gas Turbines. |
| NFPA-54  | National Fuel Gas Code.                                                 |
| NFPA-70  | National Electrical Code.                                               |
| NFPA-72  | Installation, Maintenance And Use Of Fire Alarm Systems.                |
| NFPA-90A | Installation of Air Conditioning And Ventilation Systems.               |
| NFPA-101 | Life Safety Code.                                                       |
| NFPA-780 | Standard for the Installation of Lightning Protection System.           |

#### 1.8 INVESTIGATION OF SITE

- A. Site Renovation: Verify and coordinate existing site raceways and pipes at any excavation on site. Provide hand-digging and required rerouting in areas of existing Raceways and pipes within bid price.

#### 1.9 SUPERVISION OF THE WORK

- A. Supervision: Provide one field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable sizes, type and complexity. The Superintendent shall be present at all times when work is being performed. At least one member of the Electrical Contracting Firm shall hold a State Master Certificate of Competency.

#### 1.10 COORDINATION

- A. General: Compare drawings and specifications with those of other trades and report any discrepancies between them to the Architect. Obtain from the Architect written instructions to make the necessary changes in any of the affected work. Work shall be installed in cooperation with other Trades installing interrelated work. Before installation, Trades shall make proper provisions to avoid interferences in a manner approved by the Architect.
- B. Provide all required coordination and supervision where work connects to or is affected by work of others, and comply with all requirements affecting this Division. Work required under other divisions, specifications or drawings to be performed by this Division shall be coordinated with the Contractor and such work performed at no additional cost to Owner including but not limited to electrical work required for:
1. Door hardware
  2. Roll-up doors

3. Signage
  4. Elevators
  5. Sliding or automatic doors
  6. Mechanical Division of the Specifications
  7. Landscape Architect drawings
  8. Lifts
  9. Laundry equipment
  10. Concession Equipment
  11. Interior design drawings
  12. Millwork design drawings and shop drawings
- C. Contractor shall carefully coordinate all electrical work included in theatrical lighting, systems, audio visual drawings and provide all labor and material required to perform required work.
- D. Obtain set of Contract Documents from Owner's Authorized Representative or Contractor for all areas of work noted above and include all electrical work in bid whether included in Division 16 Contract Documents or not.
- E. Secure approved shop drawings from all required disciplines and verify final electrical characteristics before roughing power feeds to any equipment. When electrical data on approved shop drawings differs from that shown or called for in Construction Documents, make adjustments to the wiring, disconnects, and branch circuit protection to match that required for the equipment installed.
- F. Damage from interference caused by inadequate coordination shall be corrected at no additional cost to the Owner.
- G. Adjustments: Locations of raceway and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Determine the exact routing and location of systems prior to fabrication or installation.
- H. Priorities: Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have the right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
- I. Modifications: Offsets and changes of direction in raceway systems shall be made to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. Provide elbows, boxes, etc., as required to allow offsets and changes to suit job conditions.
- J. Replacement: Work shall be installed in a way to permit removal (without damage to other parts) of other system components provided under this Contract requiring periodic replacement or maintenance. Raceway shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles.
- K. Layout: The Contract Drawings are diagrammatic only intending to show general runs and locations of raceway and equipment, and not necessarily showing required offsets, details and accessories and equipment to be connected. Work shall be accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation, which will afford maximum accessibility for operation, maintenance and headroom.

- L. Contract Conflicts: Where discrepancies exist in the Scope of Work as to what Trade provides items such as starters, disconnects, flow switches, etc. such conflicts shall be coordinated between the divisions involved. It is the intent of the Contract Documents that all work shall be provided complete as one bid price.
- M. Drawing Conflicts: Where drawing details, plans or specification requirements are in conflict and where sizes of the same item run are shown to be different within the contract documents, the most stringent requirement shall be included in the Contract. Systems and equipment called for in the specification or as shown on the drawings shall be provided as if it was required by both the drawings and specifications. Prior to ordering or installation of any portion of work, which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided.
- N. It is the responsibility of this Contractor to coordinate the exact required location of floor outlets, floor ducts, floor stub-ups, etc. with Owner's Authorized Representative and Designer (and receive their approval) prior to rough-in. Locations indicated in Contract Documents are only approximate locations.
- O. The Contract Documents describe specific sizes of switches, breakers, fuses, Raceways, conductors, motor starters and other items of wiring equipment. These sizes are based on specific items of power consuming equipment (heaters, lights, motors for fans, compressors, pumps, etc.). Coordinate the requirements of each load with each load's respective circuitry shown and with each load's requirements as noted on its nameplate data and manufacturer's published electrical criteria. Adjust circuit breaker, fuse, Raceway, and conductor sizes to meet the actual requirements of the equipment being provided and installed and change from single point to multiple points of connection (or vice versa) to meet equipment requirements. Changes shall be made at no additional cost to the Owner.
- P. Working Clearances: Minimum working clearances about electrical equipment shall be as referenced in the applicable edition NEC Article 110, and shall include equipment installed in ceiling spaces.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Specified Method: Where several brand names, make or manufacturers are listed as acceptable each shall be regarded as equally acceptable, based on the design selection but each must meet all specification requirements. Where a manufacturer's model number is listed, this model shall set the standard of quality and performance required. Where no brand name is specified, the source and quality shall be subject to Engineer's review and acceptance. Where manufacturers are listed, one of the listed manufacturers shall be submitted for acceptance. No substitutions are permitted.
- B. Certification: When a product is specified to be in accordance with a trade association or government standard requested by the Engineer, Contractor shall provide a certificate that the product complies with the referenced standard. Upon request of Engineer, Contractor shall submit supporting test data to substantiate compliance.
- C. Basis of Bid: Each bidder represents that his bid is based upon the manufacturer's, materials, and equipment described in the Contract Documents.



- D. Space Requirements: Equipment or optional equipment shall conform to established space requirements within the project. Equipment which does not meet space requirements, shall be replaced at no additional expense to the Contract. Modifications of related systems shall be made at no additional expense to the Contract. Submit modifications to the Architect/Engineer for acceptance.

## 2.2 SHOP DRAWINGS

- A. General: Shop drawings shall be submitted for every item listed within the Submittals section each individual specification section. One copy shall be submitted to the engineer prior to ordering equipment. Refer to Basis of approval paragraph.
- B. Responsibility: It is the Contractors responsibility to provide material in accordance with the plans and specifications. Material not provided in accordance with the plans and specifications shall be removed and replaced at the Contractors expense.
- C. Official Record: The shop drawing submittal shall become the official record of the materials to be installed. If materials are installed which do not correspond to the record submittal they shall be removed from the project without any additional cost or delays in construction completion.
- D. Information: The shop drawing record submittal shall include the following information to the extent applicable to the particular item;
1. Manufacturer's name and product designation or catalog number.
  2. Standards or specifications of ANSI, ASTM, ICEA, IEEE, ISA, NEMA, NFPA, OSHA, UL, or other organizations, including the type, size, or other designation.
  3. Dimensioned plan, sections, and elevations showing means for mounting, Raceway connections, and grounding, and showing layout of components.
  4. Materials and finish specifications, including paints.
  5. List of components including manufacturer's names and catalog numbers.
  6. Internal wiring diagram indicating connections to components and the terminals for external connections.
  7. Manufacturer's instructions and recommendations for installation, operation, and maintenance.
  8. Manufacturer's recommended list of spare parts.
  9. Provide 1/2" = 1'-0" enlarged electrical room layout drawings for all electrical rooms. All equipment shall be indicated at actual size of equipment being provided. All dimensions and required working clearances shall be shown.
- E. Preparation: Prior to submittal, shop drawings shall be checked for accuracy and contract requirements. Shop drawings shall bear the date checked and shall be accompanied by a statement that the shop drawings have been examined for conformity to Specifications and Drawings. This statement shall also list discrepancies with the Specifications and Drawings. Shop drawings not so checked and noted shall be returned to Contractor unreviewed.
- F. Basis of Review: Approval is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Contractor is responsible for quantities, dimensions, fabrication processes, and construction techniques.

- G. Responsibility: The responsibility that dimensions are confirmed and correlated with proper coordination of other trades shall be included as part of the Contract Documents. The responsibility and the necessity of providing materials and workmanship required by the Specifications and Drawings which may not be indicated on the shop drawings shall be included as part of the Contract Documents. The Contractor is responsible for any delays in job progress occurring directly or indirectly from late submissions or re-submissions of shop drawings, product data, or samples.
- H. Ordering Equipment: No material shall be ordered or shop work started until the Engineer's has officially received the shop drawings record submittal and has formally released the Contractor for submittal requirements.
- I. Brochure Requirements: Submit Technical Information Brochures at the start of construction or no later than 30 days after Award of the Contract. Each brochure shall consist of an adequately sized, hardcover, 3-ring binder for 8-1/2" X 11" sheets. Provide correct designation on outside cover and on end of brochure. When one binder is not enough to adequately catalog all data, an additional binder shall be submitted.
- J. Brochure Contents: First sheet in the brochure shall be a photocopy of the Electrical Index pages in these specifications. Second sheet shall be a list of Project Addresses for this project. Third sheet shall list Project Information. Provide reinforced separation sheets tabbed with the appropriate specification reference number and typed index for each section in the Electrical Schedule. Technical Information consisting of marked catalog sheets or shop drawings shall be inserted in the brochure in proper order on all items specified and shown on drawings. At the end of the brochure, provide and insert a copy of the specifications for this Division and all addenda applicable to this Division.
- K. Contractor's Review: Review the brochures before submitting to the Engineer. No request for payment shall be considered until the brochure has been reviewed, stamped and submitted for review.
- L. Cost: Submit cost breakdown on work in the Technical Information Brochures. The cost of material and labor for each item shall be indicated. The cost of fittings and incidentals are not required.
- M. Title Drawings: Title drawings to include identification of project and names of Architect-Engineer, Engineer, Contractors, and/or supplier, data, number sequentially and indicate in general;
  - 1. Fabrication and Erection dimensions.
  - 2. Arrangements and sectional views.
  - 3. Necessary details, including complete information for making connections with other work.
  - 4. Kinds of materials and finishes.
  - 5. Descriptive names of equipment.
  - 6. Modifications and options to standard equipment required by the contract.
  - 7. Leave blank area, size approximately 4 by 2-1/2 inches, near title block (for Engineer's stamp imprint).
  - 8. In order to facilitate review of shop drawings, they shall be noted, indicating by cross-reference the contract drawings, notes, and specification paragraph numbers where items occur in the contract documents.
  - 9. See specific sections of specifications for further requirements.

- N. Technical Data: Submit technical data verifying that the item submitted complies with the requirements of the specifications. Technical data shall include manufacturer's name and model number, dimensions, weights, electrical characteristics, and clearances required. Indicate optional equipment and changes from the standard item as called for in the specifications. Provide drawings, or diagrams, dimensioned and in correct scale, covering equipment, showing arrangement of components and overall coordination.
- O. Same Manufacturer: In general, relays, contactors, starters, motor control centers, switchboards, panelboards, dry type transformers, disconnect switches, circuit breakers, manual motor starter switches, etc., shall be supplied and manufactured by the same manufacturer. This requirement shall apply to same type of electrical components specified in other Divisions.

## 2.3 EQUIPMENT, MATERIALS, AND SUPPORTS

- A. General: Each item of equipment or material shall be manufactured by a company regularly engaged in the manufacture of the type and size of equipment, shall be suitable for the environment in which it is to be installed, shall be approved for its purpose, environment, and application, and shall bear the UL label.
- B. Installation Requirements: Each item of equipment or material shall be installed in accordance with instructions and recommendations of the manufacturer, however, the methods shall not be less stringent than specified herein.
- C. Required Accessories: Provide all devices and materials, such as expansion bolts, foundation bolts, screws, channels, angles, and other attaching means, required to fasten enclosures, raceways, and other electrical equipment and materials to be mounted on structures which are existing or new.
- D. Protection: Electrical equipment shall at all times during construction be adequately protected against mechanical injury or damage by the elements. Equipment shall be stored in dry permanent shelters. If apparatus has been damaged, such damage shall be repaired at no additional cost or time extension to the Contract. If apparatus has been subject to possible injury, it shall be thoroughly cleaned, dried out and put through tests as directed by the Manufacturer and Engineer, or shall be replaced, if directed by the Engineer, at no additional cost to the Contract.

## 2.4 IDENTIFICATION OF EQUIPMENT

- A. General: Electrical items shall be identified as specified in the Contract Documents. Such identification shall be in addition to the manufacturer's nameplates and shall serve to identify the item's function and the equipment or system, which it serves or controls. Refer to Identification Section of the specifications for additional information.

## 2.5 CONCRETE PADS

- A. General: Provide reinforced concrete pads for floor mounted electrical equipment. Unless otherwise noted, pads shall be nominal four (4) inches high and shall exceed dimensions of equipment being set on them, including future sections, by six (6) inches on all sides, except when equipment is flush against a wall, then the side or sides against the wall shall be flush with the equipment. Chamfer top edges 1/2". Trowel surfaces smooth. Reinforce pads with #5 reinforcing bars at 24" centers each way, unless specifically detailed on drawings.

## 2.6 SURFACE MOUNTED EQUIPMENT

- A. General: Surface mounted fixtures, outlets, cabinets, panels, etc. shall have a factory-applied finish or shall be painted as accepted by Engineer. Raceways and fittings, where allowed to be installed surface mounted, shall be painted to match the finish on which it was installed. Paint shall be in accordance with other applicable sections of these specifications.

## 2.7 CUTTING AND PATCHING

- A. Core Drilling: The Contractor shall be responsible for core drilling as required for work under this section, but in no case shall the Contractor cut into or weld onto any structural element of the project without the written approval of the Architect.
- B. Cutting and Patching: Cutting, rough patching and finish patching shall be provided as specified in the contract documents. Cutting and patching shall be performed in a neat and workmanlike manner. Upon completion, the patched area shall match adjacent surfaces.
- C. Openings and Sleeves: Locate openings required for work performed under this section. Provide sleeves, guards or other accepted methods to allow passage of items installed under this section.
- D. Roof Penetration: Provide roofer with pitch pans, fittings, etc., required for electrical items which penetrate the roof. Roof penetrations are to be waterproofed in such a manner that roofing guarantees are fully in force. Roof penetrations shall be coordinated with other Trades to ensure that roof warranty is not invalidated.

## 2.8 SLEEVES AND FORMS FOR OPENINGS

- A. Sleeves: Provide sleeves for Raceways penetrating floors, walls, partitions, etc. Locate necessary slots for electrical work and form before concrete is poured. Watertight sleeves shall be line seal type WS. Fire rated partition sleeves shall be mild steel. Size shall be one standard diameter larger than pipe being installed or of a larger diameter to below 1/4" minimum clearance.
- B. Forms: Provide boxed out forms for Raceway penetrations only where allowed by the Architect. Fill opening after Raceway installation, with equivalent material.

## 2.9 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. General: Thoroughly instruct the Owner's Representative, to the complete satisfaction of the Architect and Engineer, in the proper operation of all systems and equipment provided. The Contractor shall make all arrangements, via the Architect, as to whom the instructions are to be given in the operation of the systems and the period of time in which they are to be given. The Architect shall be completely satisfied that the Owner's Representative has been thoroughly and completely instructed in the proper operation of all systems and equipment before final payment is made. If the Architect determines that complete and thorough instructions have not been given by the Contractor to the Owner's Representative, then the Contractor shall be directed by the Architect to provide whatever instructions are necessary until the intent of this paragraph of the Specification has been complied with.
- B. Submittals: Submit to the Architect for approval five (5) typed sets, bound neatly in loose-leaf binders, of instructions for the installation, operation, care and maintenance of equipment and systems, including instructions for the ordering and stocking of spare parts for equipment installed under this contract. The lists shall include part number and suggested suppliers. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.
- C. Information Requirements: Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub index for each section shall also be provided.
- D. Instructions: The instructions shall contain information deemed necessary by the Architect and include but not limited to the following:
  - 1. Introduction:
    - a. Explanation of Manual and its use.
    - b. Summary description of the Electrical Systems.
    - c. Purpose of systems.
  - 2. System:
    - a. Detailed description of all systems.
    - b. Illustrations, schematics, block diagrams, catalog cuts and other exhibits.
  - 3. Operations:
    - a. Complete detailed, step by step, sequential description of all phases of operation for all portions of the systems, including start up, shutdown and balancing. Include posted instruction charts.
  - 4. Maintenance:
    - a. Parts list and part numbers.
    - b. Maintenance and replacement charts and the Manufacturer's recommendations for preventive maintenance.
    - c. Trouble shooting charts for systems and components.
    - d. Instructions for testing each type of part.
    - e. Recommended list of on-hand spare parts.
    - f. Complete calibration instructions for all parts and entire systems.
    - g. General and miscellaneous maintenance notes.

5. Manufacturer's Literature:
  - a. Complete listing for all parts.
  - b. Names, addresses and telephone numbers.
  - c. Care and operation.
  - d. All pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
  - e. Internal wiring diagrams and Engineering data sheets for all items and/or equipment furnished under each Contract.
  - f. Guarantee and warranty data.

## PART 3 - EXECUTION

### 3.1 WORKMANSHIP

- A. General: The installation of materials and equipment shall be performed in a neat, workmanlike and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the Contract Documents. They shall be skilled in the methods and craftsmanship needed to produce a quality level of workmanship. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.
- B. Acceptable Workmanship: Acceptable workmanship is characterized by first-quality appearance and function, conforming to applicable standards of building system construction, and exhibiting a high degree of quality and proficiency which is judged by the Architect as equivalent or better than that ordinarily produced by qualified industry tradesmen.
- C. Performance: Personnel shall not be used in the performance of the installation of material and equipment who, in the opinion of the Architect, are deemed to be careless or unqualified to perform the assigned tasks. Material and equipment installations not in compliance with the Contract Documents, or installed with substandard workmanship and not acceptable to the Architect, shall be removed and reinstalled by qualified craftsmen, at no change in the contract price.

### 3.2 PROTECTION AND CLEAN UP

- A. Protection and Restoration: Suitably protect equipment provided under this Division during construction. Restore damaged surfaces and items to "like new" condition before a request for substantial completion inspection.
- B. Handling: Materials shall be properly protected and Raceway openings shall be temporarily closed by the Contractor to prevent obstruction and damage. Post notice prohibiting the use of systems provided under this Contract, prior to completion of work and acceptance of systems by the Owner's representative. The Contractor shall take precautions to protect his materials from damage and theft.
- C. Safeguards: The Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or systems provided under this contract.

- D. Cleanup: Keep the job site free from debris and rubbish. Remove debris and rubbish from the site and leave premises in clean condition on a daily basis.

### 3.3 SYSTEMS GUARANTEE

- A. General: Provide a one-year guarantee. This guarantee shall be by the Contractor to the Owner for any defective workmanship or material, which has been provided under this Contract at no cost to the Owner for a period of one year from the date of substantial completion of the System. The guarantee shall include lamps, for ninety days after date of Substantial Completion of the System. Explain the provisions of guarantee to the Owner at the "Demonstration of Completed System".

### 3.4 FINAL OBSERVATION

- A. General: Work shall be completed, and forms and other information shall be submitted for acceptance one week prior to the request for final observation of the installation.

### 3.5 SPECIAL CONSIDERATIONS

- A. Comply with special requirements imposed at site by Owner. This may include badging of employees, prohibition of smoking, special working hours, or special working conditions.

END OF SECTION 26 05 00

## CERTIFICATE OF COMPLETED DEMONSTRATION MEMO

Note to Contractor: Do not submit this form at the time Technical Information Brochure is submitted. Submit five copies of information listed below for checking at least one week before scheduled completion of the building. After information has been accepted and inserted in each brochure, give the Owner a Demonstration of the Completed Electrical Systems and have the Owner sign five copies of this form. Provide one signed copy for each brochure. After this has been done, a written request for a final inspection of the System shall be made.

Re:

\_\_\_\_\_  
(Name of Project)

\_\_\_\_\_  
(Division Number and Name)

This memo is for the information of all concerned that the Owner has been given a Demonstration of the Completed Electrical Systems on the work covered under this Division. This conference consisted of the system operation, a tour on which all major items of equipment were pointed out, and the following items were given to the Owner;

(a) Owner's copy of Technical Information Brochure containing approved submittal sheets on all items, including the following; (To be inserted in the Technical Information Brochure after the correct tab).

- (1) Maintenance Information published by manufacturer on equipment items.
- (2) Printed Warranties by manufacturers on equipment items.
- (3) Performance verification information as recorded by the Contractor.
- (4) Check-out Memo on equipment by manufacturer's representative.
- (5) Written operating instructions on any specialized items.
- (6) Explanation of the one-year guarantee on the system.

(b) "As-Built" conditions as described in the record drawing specifications.

(c) A demonstration of the System in Operation and of the maintenance procedures which shall be required.

\_\_\_\_\_  
(Name of General Contractor)

By: \_\_\_\_\_  
(Authorized Signature, Title & Date)

\_\_\_\_\_  
(Name of SubContractor)

By: \_\_\_\_\_  
(Authorized Signature, Title & Date)

Brochure, Instruction, Prints, Demonstration & Instruction in Operation Received:

\_\_\_\_\_  
(Name of Owner)

By: \_\_\_\_\_  
(Authorized Signature, Title, Date)



cc: Owner, Architect, Engineer, Contractor, Sub Contractor and General Contractor  
(List names as stated in cc: above)

## SECTION 260519 – WIRES AND CABLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

#### 1.2 WIRES AND CABLES

- A. Description: Provide a complete and continuous system of conductors as specified herein. All conductors shall be in accordance with the latest edition of the NEC.

#### 1.3 QUALITY ASSURANCE

- A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of wire systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.
- B. Compliance: Materials shall comply with the following standards as they apply to the different wire types specified herein.

##### 1. UL:

- a. 44 - Rubber insulated wire and cables.
- b. 83 - Thermoplastic insulated wires.
- c. 486-A-80 - Wire connectors and soldering lugs for use with copper.
- d. 486B - Splicing wire connectors
- e. 493 - Thermoplastic insulated underground feeder and branch circuit cables.

##### 2. NFPA:

- a. 70 NEC

#### 1.4 SUBMITTALS

- A. General: Submit product data on all different types of conductors specified.

#### 1.5 FLEXIBLE WIRING SYSTEMS

- A. General: Provide a flexible wiring system used to supply power to lighting fixtures, poke-thru power outlets and wall receptacles as shown on the contract documents.
- B. Description: The prefabricated system shall be complete with all 120 and 4 wire power getaway boxes, fixture adapters, jumper cable sets, wall switch boxes, wall power boxes, poke-thru power outlets etc.

- C. Compliance: The system and its components shall comply with the requirements of Underwriters Laboratories, Inc. and shall be U.L. listed or labeled for intended use on this project and UL listed and labeled for use in return air plenum and rated to make and break under rated load. All work and materials shall comply with the National Electrical Code and applicable state and local building codes.
- D. Final Condition: The system shall be of construction such that when installation is complete all system components shall be metal enclosed, in a locked mode and shall comprise a fully grounded system.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Conductors: Branch circuit and feeder conductors for electric power shall be copper type. Utilize THHN/THWN insulation for branch circuits and THWN/XHHW insulation for feeders, unless specifically noted otherwise. Conductors #10 AWG and smaller shall be solid, #8 AWG and larger shall be stranded. No aluminum wiring shall be permitted. All wire shall be sized as shown on the drawings. If no size is shown, wire shall be #12 AWG, except that branch "homeruns" over 50 ft. in length shall be #10 AWG for 120/208V circuits. Wire in vicinity of heat-producing equipment shall be type XHHW insulation. All wiring shall be manufactured in the USA and of 98 percent resistivity. #14 AWG minimum size conductors shall be used for fire alarm system.
- B. Taps and Splices: All copper taps and splices in #8 AWG or smaller wire shall be fastened together by means of "wirenut" connectors (Ideal or accepted substitution). All taps and splices in wire larger than #8 AWG shall be made with compression type connectors and taped to provide insulation equal to wire. All taps and splices in manholes or in ground pull box shall be made with compression type connectors and covered with Raychem heavy wall cable sleeves (type CTE or WCS) with type "S" sealant coating. Provide sleeve kits as per manufacturer's installation instructions.
- C. Color Coding, General: All power feeders, grounding conductors and branch circuits #6 AWG and smaller shall be installed with color-coded wire with the same color used for a system throughout the building. Conductors above #6 AWG shall either be fully color-coded or shall have black insulation and be similarly color-coded with tape in all junction boxes and panels in accordance with NEC 310-12. Tape shall cover the conductor insulation within the box or panel in such a manner so as to allow standard markings to be readily observed.
- D. Colors: Unless otherwise accepted, color-code shall be as indicated in the Identification section of the specifications. All switch legs, other voltage system wiring, control and interlock wiring shall be color-coded other than those listed in the Identification Section of these specifications.
- E. Submittals: Submit cut sheets on all major types of wires and cables including splicing tape, and terminating/splicing lugs or connectors and cable sleeves.
- F. MC Cable may be utilized for lighting and receptacle branch circuit wiring only, where not restricted by NEC. MC cable shall not be used for branch circuit homeruns.

- G. Construction: MC Cable shall have galvanized steel armor. Conductors shall be THHN or XHHW type. A green insulated grounding conductor shall be included in all MC Cables. Where circuiting on drawings calls for dedicated neutrals and/or isolated ground conductors, MC Cables, if used for these circuits, shall have dedicated neutrals and/or isolated ground conductors.
- H. MC Cable shall be color-coded for cable type (standard, oversized neutral, isolated ground), conductor configuration, and circuit voltage

## 2.2 MANUFACTURERS

- A. General: Branch circuit and feeder conductors shall be manufactured by one of the following: General Cable Co., Anaconda, Pirelli, Rome Cable Corporation, or American Insulated Wire Corporation.
- B. MC Cable shall be manufactured by AFC Cable Systems.

## PART 3 - EXECUTION

### 3.1 EXECUTION

- A. General: All wiring shall be installed in conduit (power, low voltage and control wiring), unless otherwise indicated or specified under other Sections of this specification. All wiring shall be installed per the latest edition of the NEC.
- B. Connections: Conductors #10 and #12 AWG shall be connected with pre-insulated spring connectors incased in a steel shell and rated at not less than 105 degrees C. A minimum of 3/8 inch skirt shall cover the bare wires. The connector shall meet with UL approval for fixture and pressure work, and shall be "Scotch Lok" Type Y, R and B electrical spring connectors as manufactured by the 3M Company or approved equal.
- C. Connector Manufacturers: Lugs and wire connectors shall be one of the following: Burndy Corporation, Thomas & Betts, Co., Appleton or ILSCO.
- D. Equipment Installations: Neatly form, train and tie the cables in panelboards, cabinets, wireways, switches and equipment assemblies.

END OF SECTION 26 05 19

## SECTION 260526 – GROUNDING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

#### 1.2 GROUNDING ELECTRODES

- A. General: Provide a grounding electrode system, as described in NEC 250, as specified herein and as indicated on plans.
- B. Ground Field / Ground Rods: The ground field shall consist of three 20 ft long vertically driven ground rods arranged in a triangular pattern spaced 20 feet apart. Additional ground rods shall be added as necessary to achieve the desired resistance.
- C. Main Metallic Water Pipe: The building's main metallic underground water piping shall be utilized as a grounding electrode, provided the metal pipe is installed in direct contact with the earth for a minimum of 10 feet. Bond the main metallic water service within 5 ft. of the entrance of the water pipe into the building.
- D. Building Steel: The building steel shall be utilized as a grounding electrode, provided the steel is in direct contact with the earth or is otherwise effectively grounded.
- E. Resistance: Grounding electrode resistance shall not exceed 10 ohms. Overall resistance of the entire grounding electrode system shall not exceed 5 ohms. Provide additional grounding electrodes as required to meet this value. Refer to Section 26 0080 for testing requirements.

#### 1.3 GROUNDING ELECTRODE CONDUCTOR

- A. Grounding Electrode Conductor: A main grounding electrode conductor, bare copper, sized per NEC, shall be run in PVC conduit from main service equipment to the grounding electrodes. This conductor shall also be bonded to the following:
  - 1. Telecommunications service ground within 20' of the electrical service
  - 2. Lightning protection system.
  - 3. Gas and other interior metal piping – refer to NEC.

#### 1.4 SEPARATELY DERIVED GROUNDING SYSTEMS

- A. Description: Provide a separately derived grounding system where indicated herein and as required by the National Electrical Code. Bond neutral and ground busses together.
- B. Services: Provide a separately derived grounding system for all building electrical services and step-down transformers.

- C. Multiple Buildings: Multiple buildings fed from the same electrical service shall be provided with separate grounding electrode systems, as required by the NEC and specified herein.

#### 1.5 BONDING AND EQUIPMENT GROUNDING

- A. Description of System: In general, all electrical equipment (metallic conduit, motor frames, panelboards, etc.) shall be bonded together with a green insulated copper system grounding conductor in accordance with specific rules of Article 250 of the NEC. Equipment grounding conductors through the raceway system shall be continuous from main switch ground bus to panel ground bar of each panelboard, and from panel grounding bar of each panelboard to branch circuit equipment and devices.
- B. Equipment Grounding Conductors: All raceways shall have an insulated copper system ground conductor run throughout the entire length of circuit installed within conduit in strict accordance with NEC. Grounding conductor shall be included in total conduit fill when determining conduit sizes, even though not included or shown on drawings.
- C. Redundant Grounding: In general all branch circuits shall be provided with a redundant grounding system through the use of grounding conductors and metallic conduit.
- D. Bonding: In addition to connections to grounding electrodes, the main service ground shall be bonded to the lightning protection system and other underground metal piping.
- E. Bushings: Provide insulated grounding bushings on all metallic feeder conduits terminated within panelboards, switchboards or enclosed overcurrent devices. Provide insulated grounding bushings on all branch circuit conduits where concentric knockouts are used.
- F. Connection to Other Systems: Provide all required grounding and bonding connections as specified herein and as required by the National Electrical Code.

#### 1.6 SUBMITTALS

- A. General: Submit product data on ground rods, ground wire, ground connectors, ground bars, and data on exothermic welds.

#### 1.7 QUALITY ASSURANCE

- A. Compliance: The entire ground system shall meet or exceed the minimum requirements NEC 250 and IEEE Std. 142 (green book).

## PART 2 - PRODUCTS

### 2.1 GROUNDING ELECTRODE AND BONDING CONDUCTORS

- A. General: Except as specified in C below, provide UL and NEC approved types of copper with THWN, THHN, or XHHW with green insulation or green tape on black insulation the entire length of conductor not in conduit.
- B. Size: Grounding electrode conductors shall be sized as specified herein and on the drawings, but in no case shall be smaller than required by NEC 250.
- C. Insulation: Conductors above ground shall be insulated, conductors run below grade shall be bare.

### 2.2 GROUNDING ELECTRODES

- A. Ground Rods: Provide copperclad steel, 5/8 inch diameter by 20 feet long vertically driven ground rods. Use of multiple 10 feet sectional ground rods is acceptable.

### 2.3 CONNECTIONS

- A. Bonding: One piece mechanical lugs or wire terminals, properly sized and approved by the local authority having jurisdiction shall be used to bond ground wires together or to junction boxes and panel cabinets.
- B. Underground: All connections and bonds made underground and to building steel shall be exothermic weld type-connections.

### 2.4 INSPECTION WELLS

- A. Location: Provide inspection wells for all ground rods covered by concrete, paving, or other permanent materials that prevent access to ground rods.
- B. Description: Inspection well shall be provided with circular, flush traffic rated, grade mounted, twist lock traffic cover with the word "ground" (or similar) on the cover. Inspection test well shall allow clear access to the ground rod and exothermic weld connection of conductor to ground rod. Clearly mark ground rod locations on as-built drawings.

### 2.5 GROUND BAR

- A. Location: Provide a ground bar connected to the main service ground via a #4/0 grounding conductor in all electrical rooms with step-down transformers and in all communications rooms, or rooms with telephone distribution equipment or network electronics equipment.
- B. Description: Ground bar shall be 12" x 2" x 1/4" (minimum) copper bus mounted to wall 24" AFF via insulated standoffs. All connections to ground bar shall be made via approved mechanical connections.

- C. Interconnection: In addition to the main service ground, all ground bars shall be interconnected to each other via #4/0 insulated grounding conductor. Each ground bar shall also be bonded to local metallic water piping and building steel via #6 insulated grounding conductor.

## PART 3 - INSTALLATION

### 3.1 EXTERIOR

- A. Connection: The main grounding electrode conductor shall be exothermically welded to ground rods and other main system electrodes.

### 3.2 INTERIOR

- A. Installation: Equipment grounding conductors shall be installed as follows:
  - 1. Where installed in metal conduit, both conductor and conduit shall be bonded at each end.
  - 2. Have connections accessible for inspection and made with approved solderless connectors brazed (or bolted) to the equipment or structure to be grounded.
  - 3. Shall in NO case be a current carrying conductor.
  - 4. Have green insulation, except that grounding electrode conductors may be bare.
- B. Water Meter: Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe.
- C. Bushings: Bond all grounding bushings to the equipment ground bus of the panel or switchboard, or overcurrent device in which it is located. Bond shall be made via an insulated bonding conductor of same size as equipment ground conductor run in the circuit.

### 3.3 TESTING

- A. Testing: Provide testing as required in other sections of this specification, including but not limited to sections 26 0500 and 26 0080.
- B. Reports: Submit impedance test reports for all separately derived services to the Engineer prior to project completion.

### 3.4 CONNECTIONS

- A. Preparation: All contact surfaces shall be thoroughly cleaned before connections are made, to ensure good metal to metal contact.

END OF SECTION 26 05 26



## SECTION 260533 – OUTLET BOXES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

#### 1.2 DESCRIPTION

- A. General: Outlet boxes shall be of such form and dimensions as to be adapted to the specific use and location, type of device or fixtures to be used, and number and size of conductors and arrangement, size and number of conduits connecting thereto.
- B. Ceiling Size: Ceiling outlet boxes shall be 4 inch octagonal or 4 inch square by 1-1/2 inches deep or larger as required for number and size of conductors and arrangement, size and number of conduits terminating at them.
- C. Wall Size: Switch, wall receptacle, telephone and other wall outlet boxes in drywall shall be 4 inch square by 1-1/2 inches deep. For exposed masonry, provide one piece 4 inch square by 1-1/2 inches deep wall boxes with appropriate 4 inches square cut tile wall covers Steel City series #52-C-49/52-C-52 or accepted substitution. For furred-out block walls, provide 4 inch square box with required extension for block depth and required extension for drywall depth.

#### 1.3 QUALITY ASSURANCE

- A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of conduit systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.
- B. Compliance: Materials shall comply with the following standards as they apply to the different raceway types specified herein.
  - 1. UL-50 & UL-514
  - 2. NEC 70

#### 1.4 FLOOR OUTLETS

- A. General: Provide floor outlet boxes as shown on the plans. Installation shall be in accordance with the National Electrical Code, and shall be complete with service fittings as indicated. Equipment shall be listed by Underwriters' Laboratories, Inc.

#### 1.5 SPECIAL PURPOSE OUTLETS

- A. Location: Locate special purpose outlets as indicated on the drawings for the equipment served. Location and type of outlets shall be coordinated with appropriate trades involved. The securing of complete information for proper electrical roughing-in shall be included as work required under this section of specifications.

## 1.6 SUBMITTALS

- A. Submittals: Submit product data on all different types of outlet boxes and associated trim/plaster rings.

## PART 2 - PRODUCTS

### 2.1 GENERAL PURPOSE BOXES

- A. General: Provide standard galvanized one-piece steel outlet boxes at all concealed outlets for electric lights, switches, convenience receptacles, telephone outlets, etc. Acceptable manufacturers shall be T&B, Steel City, Racor. Surface outlet boxes and conduit bodies shall be the heavy cast aluminum or iron with external raised hubs - Appleton, Crouse Hinds or Steel City or accepted substitution. Trim rings shall also be of one piece construction.

### 2.2 FLOOR OUTLET BOXES

- A. Standards: Outlets in slab on grade shall conform to Federal Specifications No. WC-526b, Type 1, with threaded conduit hubs.
- B. Carpet Locations: In carpeted areas, Lexan carpet flanges shall be installed to protect carpet edges where flush floor boxes are installed.
- C. Construction: All assemblies shall be designed and installed to maintain grounding continuity, fireproofing and watertight integrity. Connections to boxes in slabs on grade shall be made tight or sealed to prevent entrance of moisture.
- D. Accessories: Box trim, service fittings and accessories shall be as required to provide a complete installation.
- E. Special Consideration: Flush caps removed to provide service fittings shall be turned over to the Owner. Approved manufacturer is Walkerduct.
- F. Manufacturer: Approved manufacturer is Walker, Racor, Steel City or Hubbell.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF OUTLET BOXES

- A. Installation: All flush outlets shall be mounted so that covers and plates shall finish flush with finished surfaces without the use of shims, mats or other devices not submitted or accepted for the purpose. Add-a-Depth ring or switch box extension rings (Steel City #SBEX) are not acceptable. Plates shall not support wiring devices. Gang switches with common plate where two or more are indicated in the same location. Wall-mounted devices of different systems (switches, thermostats, etc.) shall be coordinated for symmetry when located near each other on the same wall. Outlets on each side of walls shall have separate boxes. Through-wall type boxes shall not be permitted. Back-to-back mounting shall not be permitted. Trim rings shall be extended to within 1/8 inch of finish wall surface.
- B. Stud Walls: Outlet boxes mounted in metal stud walls, shall be supported to studs with 2 screws inside of outlet box to a horizontal stud brace between vertical studs.
- C. Blank Covers: All outlet boxes that do not receive devices in this contract are to have blank plates installed matching wiring device plates.

### 3.2 MOUNTING HEIGHT

- A. Mounting Height: Height of wall outlets to center or bottom of box above finished floor shall be as follows, unless specifically noted otherwise. Verify all heights with the architectural plans and shop drawings for installation. The following dimensions are a guide only. Specific heights required by governing institutions and laws shall apply.

Switches & Dimmers	4 foot 0 inches to centerline
Receptacles	1 foot 6 inches to centerline
Branch Panelboards	6 foot 6 inches top of panel trim
Telephone & Data Outlets	1 foot 6 inches to centerline

- B. Counter Tops: Bottoms of outlets above counter tops or base cabinets shall be minimum 2 inches above counter top or backsplash, whichever is highest. Outlets may be raised so that bottom rests on top of concrete block course, but all outlets above counters in same area shall be at same height. It is the responsibility of this Contractor to secure cabinet drawings and coordinate outlet locations in relation to all cabinets as shown on Architectural plans, prior to rough-in, regardless of height shown on documents.
- C. Wall Outlets: Height of wall-mounted fixtures shall be as shown on the drawings or as required by Architectural plans and conditions. Fixture outlet boxes shall be equipped with fixture studs when supporting fixtures.

### 3.3 FLOOR OUTLET BOXES

- A. Adjustment: Where floor or fill depth is 3 inches or more, adjustable boxes with maximum vertical and angular adjustment for after concrete pour shall be used. After pour is complete, boxes shall be set and readjusted to provide a smooth surface conforming to the elevation and slope of the surrounding finished floor.

END OF SECTION 26 05 33

## SECTION 260539 – RACEWAYS AND CONDUIT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION

- A. General: Provide all supports, hangers and inserts required to mount conduit, pullboxes and other equipment provided under this Division.
- B. Support: All items shall be supported from the structural portion of the building. Supports and hangers shall be of a type approved by Underwriters' Laboratories. Wire shall not be used as a support. Boxes and conduit shall not be supported or fastened to ceiling suspension wires or to ceiling channels. Do not install any devices supported by ceiling tiles.
- C. Installation: The Contractor shall lay out and provide his work in advance of the laying of floors or walls, and shall provide all sleeves that may be required for openings through floors, walls, etc. Where plans call for conduit to be run exposed, provide all inserts and clamps for the supporting of conduit.
- D. Systems: Provide conduit system of empty raceways including terminal cabinets, backboards and outlets as described and specified herein.

#### 1.3 QUALITY ASSURANCE

- A. Qualifications: Manufacturers shall be regularly engaged in the manufacture of conduit systems and fittings of types and sizes required, and whose products have been in satisfactory use in similar service for not less than 5 years in the USA.
- B. Aluminum Conduit: Aluminum conduit shall not be used unless specifically called for. Install with aluminum fittings only, when specified.
- C. Compliance: Materials shall comply with the latest edition of the following standards as they apply to the different raceway types specified herein;

- 1. ANSI:

- a. ANSI C80.1: Rigid Steel Conduit (RSC)
  - b. ANSI C80.3: Electrical Metallic Tubing (EMT)

- 2. UL:

- a. UL 1: Flexible Metal Conduit
  - b. UL 6: Rigid Steel Conduit (RSC)

- c. UL 360: Liquid-Tight Flexible Metal Conduit
  - d. UL 514: Fittings for Metal Conduit
  - e. UL 651: Nonmetallic Conduit (PVC)
  - f. UL 797: Electrical Metallic Tubing (EMT)
  - g. UL 886: Fittings for Hazardous Locations
  - h. UL 1242: Intermediate Metal Conduit (IMC)
3. NEMA:
- a. NEMA TC2: Rigid Nonmetallic Conduit (PVC)
  - b. NEMA TC3: Fittings for Rigid Nonmetallic Conduit (RNMC)
  - c. NEMA TC8: Utility Duct Type EB-35
  - d. NEMA RN1: Plastic Coated Metal Conduit
  - e. NEMA VE-1: Ladder Cable Tray
  - f. NEMA 8A, 8B, 8C, & 12A: Spine Cable Tray
4. Federal Specifications:
- a. WW-C-581: Rigid Steel Conduit (RSC)
  - b. WW-C-563: Electrical Metallic Conduit (EMT)
  - c. WW-C-566: Flexible Steel Conduit
  - d. WW-C-581E: Intermediate Metallic Conduit (IMC)
  - e. WC-1094A: Nonmetallic Rigid Conduit (PVC)
  - f. WC-582A Conduit, Raceway, Metal and Fittings; surface
5. ASTM:
- a. ASTM-F-512: Utility duct type EB-35
  - b. ASTM-A525 & ASTM-386: Tray manufacturers

#### 1.4 SUBMITTALS

- A. Products: Submit manufacturer's product data, including technical information on each type of raceway system;
- 1. Conduit - Metal
  - 2. Conduit fittings
  - 3. Plastic (PVC) solvent
  - 4. Black mastic coating for conduit
  - 5. Insulating and grounding bushings for conduit
  - 6. Galvanizing and protective coatings for conduit
- B. Compliance: Product data shall show compliance with this section of the specifications, including U.L. label, manufacturer and manufacturer's written installation instructions.

## 1.5 CONDUIT

- A. General: Provide a complete and continuous system of raceways to maintain a protected path for wires and cables to distribute electric power, and low voltage systems throughout the project, utilizing U.L. listed and labeled materials.
- B. Accessories: Provide conduit accessories of types, sizes, and materials, as specified herein complying with manufacturers published product information, which match and mate conduit and tubing.
- C. Interior Minimum Size: Minimum conduit size for light and power systems shall be 3/4 inch conduit for all power and lighting circuitry homeruns from panelboard to outlet box at first power consuming devices. The remainder of circuitry may be in 1/2 inch conduit, if it contains no more than 4 conductors per conduit (excluding the equipment grounding conductor), and phase conductors no larger than #12 AWG. Switchlegs may be 1/2 inch conduit unless otherwise noted on drawings.
- D. Site Underground Conduit: Unless otherwise noted, minimum underground raceways shall be 1 inch conduit. Homeruns from the branch circuit overcurrent device, through any control devices to the first exterior junction box or consumption device shall be 1 inch minimum.
- E. System Conduit: Provide end bushings on all conduits.
- F. Pull Strings: Provide pull strings in all empty raceways. Pull strings shall be nylon and shall be impervious to moisture. Pull strings installed in one inch and smaller conduits shall have a tensile strength of not less than 30 lbs. Pull strings installed in conduits larger than 1 inch shall have a tensile strength not less than 200 lbs.
- G. Conduit Bends: The use of NEC Table 346.10 Exception is not allowed.

## 1.6 LOCATIONS

- A. Materials Above Grade: The following conduit types are to be installed above grade where specifically noted herein;
  - 1. Electrical metallic tubing (thin wall)
  - 2. Flexible metal conduit
  - 3. Liquid-tight flexible metal conduit
  - 4. Galvanized rigid steel conduit
- B. Materials Below Grade: The following conduit types are to be installed below grade where specifically noted herein;
  - 1. Rigid galvanized conduit (heavy wall)
  - 2. Schedule 40 PVC
- C. Materials on Roofs: The following conduit types are to be installed on roofs where specifically noted herein;
  - 1. Rigid steel conduit

## PART 2 - PRODUCTS

### 2.1 ELECTRICAL METALLIC TUBING

- A. Fittings: Steel fittings shall be fitted with nonremovable insulated throats, and male threaded ends provided with a locknut.
- B. Locknuts: Provide locknuts for securing conduit to enclosures with sharp edges for digging into metal, and ridged outside circumference for proper fastening.

### 2.2 BUSHINGS

- A. Bushings: Bushings shall be provided on all terminations, mounted on the ends of all EMT connectors 1-1/4 inches and larger and within all equipment.
- B. Construction: Bushings shall have a flared bottom and ribbed sides, with smooth insides to prevent damage to cable insulation.
- C. Insulating Ring: Mold a phenolic insulating ring into sizes 1-1/4 inches and larger.
- D. Grounding: Provide a screw type grounding terminal on all sizes.

### 2.3 RIGID METAL CONDUIT

- A. Conduit: Conduit ends shall have precision cut hi-torque threads. One end of the conduit shall have a coupling and the other shall be covered with a color-coded plastic thread protector. Conduit shall be manufactured in 10 foot lengths.
- B. Fittings: Fittings shall be cut groove steel. Cast fittings are not acceptable.

### 2.4 FLEXIBLE STEEL CONDUIT

- A. Conduit and Standards: A continuous length, spirally wound steel strip, zinc-coated, each convolution interlocked with following convolution into a helix form. Product shall meet Federal Specification WW-C-566 and UL 1242.
- B. Fittings: Provide conduit fittings for use with flexible steel conduit of the threadless hinged clamp type, and a male threaded end provided with a locknut.
  - 1. Straight terminal connectors shall be one piece body, female end with clamp and deep slotted machine screw for securing conduit.
  - 2. 45 and 90 degree terminal angle connectors shall be 2 piece body, with removable upper section, female end with clamp and deep slotted machine screw for securing conduit.



## 2.5 LIQUID-TIGHT FLEXIBLE STEEL CONDUIT

- A. Conduit: Plastic jacketed (PVC) liquid-tight flexible steel conduit with copper bonding conductor, and steel material galvanized inside and outside.
- B. Fittings: Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings with insulated throat.

## 2.6 HEAVY WALL PVC CONDUIT (SCHEDULE 40)

- A. Conduit: Schedule 40, 90 degrees C. UL rated, PVC conduit shall be composed of High Impact PVC (polyvinyl chloride C-2000 Compound), and shall conform to industry standards, and be UL listed in accordance with Article 347 of National Electrical Code for underground and exposed use. Materials must have tensile strength of 55 PSI, at 70 degrees F., flexural strength of 11,000 psi, compression strength of 8600 psi. Manufacturer shall have five years extruding PVC experience.

## 2.7 SUPPORTING DEVICES

- A. Hangers: Hangers shall be made of durable materials suitable for the application involved. Where excessive corrosive conditions are encountered, hanger assemblies shall be protected after fabrication by galvanizing, or approved suitable preservative methods.
- B. Materials: Insert anchors shall be installed on concrete or brick construction, with hex head machine screws. Recessed head screws shall be used in wood construction. An electric or hand drill shall be used for drilling holes for all inserts in concrete or similar construction. Installed inserts, brick, shall be near center of brick, not near edge or in joint. Drilled and tapped, and round head machine screws shall be used where steel members occur. All screws, bolts, washers, etc., used for supporting conduit or outlets shall be fabricated from rust-resisting metal, or accepted substitution. Gunpowder set anchors are not permitted.
- C. Exterior: Supporting devices for exterior use shall be 316 stainless steel unless otherwise noted on drawings.
- D. PVC Coated Conduit: Supporting devices for PVC coated conduit shall be as manufactured by the PVC coated conduit manufacturer and shall match in color and appearance.

## 2.8 TELEPHONE TERMINAL BOARDS

- A. Terminal Boards: Telephone Boards shall be 8 foot high and of the width shown unless otherwise noted. Terminal boards shall be 3/4 inch A/C grade exterior plywood painted light gray with fire resistant paint.
- B. Grounding: Each terminal board shall be provided with a #3/0 AWG bare copper conductor installed in 3/4 inch PVC conduit to the building service ground. Service ground attachment shall be made with an approved lug. Provide 6 foot excess ground conductor length at terminal board for connection to equipment.

- C. Terminal Board Conduits: Conduits at Terminal board locations shall be neatly racked on a Kindorf Type rack secured to wall above and below terminal boards.

## PART 3 - EXECUTION

### 3.1 CONDUITS

- A. Provide as a minimum 3/4 inch conduit from each of the following device locations to cable tray or corridor ceiling cavity when cable tray is not available. Provide insulated bushings at ends of all conduits.
  - 1. Telephone
  - 2. DDC
  - 3. Data
  - 4. Security
- B. All fire alarm wiring shall be run in conduit.
- C. Provide plenum-rated cable for all systems conductors.

### 3.2 TELEPHONE COMPANY COORDINATION

- A. Telephone Company: The Contractor shall notify the Telephone Company when the conduit system is being installed. The Contractor shall coordinate the work with the Telephone Company as required.

### 3.3 CABLE TV COMPANY COORDINATION

- A. Cable Television Company: The Contractor shall notify the Cable Television Company when the conduit system is being installed. The Contractor shall coordinate the work with the Cable Television Company as required.

### 3.4 IDENTIFICATION OF BOXES

- A. Tags: During installation of pull strings all pull strings shall be marked with vinyl tags indicating where the opposite end may be found.

### 3.5 BLANK PLATES

- A. Plates: Unless otherwise noted all outlet boxes shall receive blank plates matching the finish of plates on electrical devices in the same room.

### 3.6 RACEWAY INSTALLATION

- A. Support: All raceways shall be run in a neat and workmanlike manner and shall be properly supported and in accordance with the latest edition of the NEC. Supporting conduit and boxes with wire is not acceptable. Exposed raceways where allowed, shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry. All conduits shall be securely fastened in place with at least one support per eight foot section. Support within one foot of changes in direction. All required hangers, supports and fastenings shall be provided at each elbow and at no more than one foot from the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits shall not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- B. Hanger Installation: Where 2 or more conduits 1 inch or larger run parallel trapeze hangers may be used consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or approved clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.
- C. Sealant: Provide a closed cell silicone foam sealant rated to provide a rating equal to the wall, ceiling, or floor assembly rating. Provide seals for the exterior of conduit penetrations consisting of a cast-in-place sleeve with a compressible rubber gasket between the conduit and the sleeve. Provide seals for the interior of the conduit penetrations consisting of gland type sealing bushing or closed cell silicone foam. Provide duct seal inside an appropriate seal-off fitting to seal the interior of the conduit system from water seepage or hazardous gases.
- D. Routing: Conduits shall be run parallel to building walls wherever possible, exposed or concealed as specified, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.
- E. Location: All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Surface mounted devices and equipment shall be specifically noted on the contract drawings. It is the intent that all raceways shall be run concealed unless specifically noted.
- F. Protection: All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction until wires are pulled in and covers are in place. No conductors shall be pulled into raceways until the raceway system is complete.
- G. Coordination: All raceways shall be kept clear of mechanical equipment and plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

### 3.7 RACEWAY INSTALLATION

- A. Support: All raceways shall be run in a neat and workmanlike manner and shall be properly supported and in accordance with the latest edition of the NEC. Supporting conduit and boxes with wire is not acceptable. Exposed raceways where allowed, shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry. All conduits shall be securely fastened in place with at least one support per eight foot section. Support within one foot of changes in direction. All required hangers, supports and fastenings shall be provided at each elbow and at no more than one foot from the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits shall not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- B. Hanger Installation: Where 2 or more conduits 1 inch or larger run parallel trapeze hangers may be used consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or approved clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.
- C. Sealant: Provide a closed cell silicone foam sealant rated to provide a rating equal to the wall, ceiling, or floor assembly rating. Provide seals for the exterior of conduit penetrations consisting of a cast-in-place sleeve with a compressible rubber gasket between the conduit and the sleeve. Provide seals for the interior of the conduit penetrations consisting of gland type sealing bushing or closed cell silicone foam. Provide duct seal inside an appropriate seal-off fitting to seal the interior of the conduit system from water seepage or hazardous gases.
- D. Routing: Conduits shall be run parallel to building walls wherever possible, exposed or concealed as specified, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.
- E. Location: All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Surface mounted devices and equipment shall be specifically noted on the contract drawings. It is the intent that all raceways shall be run concealed unless specifically noted.
- F. Protection: All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction until wires are pulled in and covers are in place. No conductors shall be pulled into raceways until the raceway system is complete.
- G. Coordination: All raceways shall be kept clear of mechanical equipment and plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

### 3.8 RACEWAY INSTALLATION

- A. Support: All raceways shall be run in a neat and workmanlike manner and shall be properly supported and in accordance with the latest edition of the NEC. Supporting conduit and boxes with wire is not acceptable. Exposed raceways where allowed, shall be supported with clamp fasteners with toggle bolt on hollow walls, and with lead expansion shields on masonry. All conduits shall be securely fastened in place with at least one support per eight foot section. Support within one foot of changes in direction. All required hangers, supports and fastenings shall be provided at each elbow and at no more than one foot from the end of each straight run terminating at a box or cabinet. The use of perforated iron for supporting conduits shall not be permitted. The required strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clamp-backs, or other accepted devices with suitable bolts, expansion shields (where needed) or beam-clamps for mounting to building structure or special brackets.
- B. Hanger Installation: Where 2 or more conduits 1 inch or larger run parallel trapeze hangers may be used consisting of concrete inserts, threaded solid rods, washers, nuts and galvanized "L" angle iron, or Unistrut cross members. These conduits shall be individually fastened to the cross member of every other trapeze hanger with galvanized cast one hole straps, clamp backs, bolted with proper size cadmium machine bolts, washers and nuts. If adjustable trapeze hangers are used to support groups of parallel conduits, U-bolt type clamps shall be used at the end of a conduit run and at each elbow. J-bolts, or approved clamps, shall be installed on each third intermediate trapeze hanger to fasten each conduit.
- C. Sealant: Provide a closed cell silicone foam sealant rated to provide a rating equal to the wall, ceiling, or floor assembly rating. Provide seals for the exterior of conduit penetrations consisting of a cast-in-place sleeve with a compressible rubber gasket between the conduit and the sleeve. Provide seals for the interior of the conduit penetrations consisting of gland type sealing bushing or closed cell silicone foam. Provide duct seal inside an appropriate seal-off fitting to seal the interior of the conduit system from water seepage or hazardous gases.
- D. Routing: Conduits shall be run parallel to building walls wherever possible, exposed or concealed as specified, and shall be grouped in workmanlike fashion. Crisscrossing of conduits shall be minimized.
- E. Location: All raceways except those from surface-mounted switches, outlet boxes or panels shall be run concealed from view. Surface mounted devices and equipment shall be specifically noted on the contract drawings. It is the intent that all raceways shall be run concealed unless specifically noted.
- F. Protection: All raceway runs, whether terminated in boxes or not, shall be capped during the course of construction until wires are pulled in and covers are in place. No conductors shall be pulled into raceways until the raceway system is complete.
- G. Coordination: All raceways shall be kept clear of mechanical equipment and plumbing fixtures to facilitate future repair or replacement of said fixtures without disturbing wiring. Except where it is necessary for control purposes, all raceways shall be kept away from items producing heat.

- H. Masonry Installation: All raceway runs in masonry shall be installed at the same time as the masonry so that no face cutting is required, except to accommodate boxes.
- I. Arrangement: All raceways shall be run connecting outlet to circuits generally as shown on the drawings. Provide circuit connection arrangement shown. Actual final arrangement shall be in accordance with the record drawings section as specified herein.
- J. Grounding: All branch circuit and feeder raceways shall have a copper system ground conductor within the conduit throughout the entire length of the circuit. All conduits shall be electrically continuous to establish redundant grounding.
  - 1. Branch circuit raceways shall have an insulated equipment grounding conductor installed within the conduit raceway system.
  - 2. Grounding conductor shall be included in total conduit fill determining conduit sizes, even though not shown on drawings.
  - 3. Grounding conductors run with feeders may be bare.
- K. Empty Raceways: Raceways which do not have conductors provided under this Division of the specifications shall be left with an acceptable nylon pullcord in raceway.
- L. Manufacturer: Rigid Metallic Conduit, Electrical Metallic Tubing, Flexible Steel Conduit, Liquid-Tight Flexible Conduit, and PVC Conduit shall be manufactured within the United States, and each shall be as manufactured by one manufacturer.
- M. Roof Installation: Conduit installations on roofs shall be kept to a bare minimum. Conduit shall be supported above roof at least 6 inches using approved conduit supporting devices. Supports shall be fastened to roof using roofing adhesive as specified in other sections of this specification.
- N. Firewall Installation: Provide pullboxes, junction boxes, fire barrier at fire rated walls etc., as required by NEC Article 300 where required.
- O. Dissimilar Metals: Avoid the use of dissimilar metals to reduce the possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
- P. Sealoff Fittings: Provide conduit sealoffs wherever the raceway system enters a hazardous or wet area or areas of drastic temperature change such as coolers, freezers, etc. as required.
- Q. Identification: Provide appropriate identification as required by codes and as indicated on the drawings and in accordance with the methods specified herein.
- R. Conduit: Conduits shall be anchored down to prevent floating while pouring in concrete.

### 3.9 SITE UNDERGROUND CONDUIT INSTALLATION

- A. General: All underground raceways (with exception of raceways installed under floor slab) shall be installed in accordance with Section 300-5 of the NEC except that the minimum cover for any conduit or duct bank shall be two feet, unless otherwise indicated.

- B. Stubs: Spare conduit stubs shall be capped and accurately dimensioned on as-built drawings.
- C. Separation: All conduit run underground, or stubbed above floor shall be separated with plastic interlocking spacers manufactured specifically for this purpose, or shall be strapped to Kindorf channel supported by conduit driven into ground or tied to steel.
- D. Coating: Rigid metallic conduit installed underground shall be coated with waterproofing black mastic before installation, and all joints shall be recoated after installation.

### 3.10 RIGID METALLIC CONDUIT

- A. Locknuts: Rigid steel box connections shall be made with double locknuts and bushings. Turn down on threads to solidly connect raceway to box or enclosure.
- B. Bushings: Grounded insulated bushings shall be used on all rigid steel conduits terminating in panels, wire gutters, or cabinets. Bushing shall be impact resistant plastic molded in an irregular shape at the top to provide smooth insulating surface at top and inner edge. Material in these bushings must not melt or support flame.

### 3.11 PVC CONDUIT

- A. Floor Penetrations Exposed: Where PVC penetrates a floor in an exposed location from underground or in slab, a black mastic coated steel conduit elbow shall be used.
- B. Location: No PVC shall be allowed anywhere except underground or in slab.
- C. Ground Conductor Installation: All individual bare copper ground conductors (i.e. service, transformer, or lightning protection grounds) shall be installed in PVC conduit.
- D. Joints: PVC joints shall be solvent welded. Threads shall not be permitted on PVC conduit and fittings, except for rigid steel to PVC couplings. Installation of PVC conduit shall be in accordance with manufacturer's recommendations.
- E. Restrict Support: PVC conduit shall not be used to support fixture or equipment.
- F. Bends: Field bends shall be made with an approved hotbox. Heating with flame and hand held dryers are prohibited.

### 3.12 FLEXIBLE CONNECTIONS

- A. Vibrating Equipment Connection: All connections to motors or other vibrating equipment (except dry type transformers) or at other locations where required shall be made with not less than 12 inches of flexible liquid-tight steel conduit, using special type of connectors with strain relief fittings at both terminations of conduit, Kellems Type 074-09 Series or accepted substitution.
- B. Normal Type: Flex connectors shall have insulated throat and shall be T & B 3100 Series or accepted substitution.

- C. Angle Type: Use angle connectors wherever necessary to relieve angle strain on flex conduit.

### 3.13 ELECTRICAL METALLIC TUBING

- A. Location: Install Electrical Metallic Tubing (thin wall) inside buildings, above the ground floor where not subject to mechanical injury.
- B. Handling: All cut ends shall be reamed to remove rough edges.

END OF SECTION 26 05 39



## SECTION 260553 – ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

#### 1.2 DESCRIPTION

- A. Extent: Electrical identification work as required by the Contract Documents or other specifications.
- B. Types: Electrical identification work specified in the Contract Documents include the following;
  - 1. Electrical power, control and communication conductors.
  - 2. Operational instructions and warnings.
  - 3. Danger signs.
  - 4. Conduits, boxes, etc.
  - 5. Distribution Equipment.
  - 6. Cabinets.
  - 7. Equipment/system identification signs and tags.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacturer of electrical identification products of types required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. NEC Compliance: Comply with NEC as applicable to installation of identifying labels and markers for wiring and equipment.
- C. UL Compliance: Comply with applicable requirements of UL Standard 969, "Marking and Labeling Systems", pertaining to electrical identification systems.
- D. ANSI Compliance: Comply with applicable requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems", and ANSI Standard Z53.1 "Color Designation."
- E. NEMA Compliance: Comply with applicable requirements of NEMA Standard No's. WC-1 and WC-2 pertaining to identification of power and control conductors.
- F. ADA Compliance: All signage shall meet ADA standards. Identification for maintenance purposes shall be as specified herein.

#### 1.4 SUBMITTALS

- A. General: Submit shop drawings of all identification materials to be used for this project. Submit one sample of each item with the shop drawings.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE SUPPLIERS OR MANUFACTURERS

- A. General: Subject to compliance with requirements, manufacturers offering electrical identification products which may be incorporated in the work include, but not limited to, the following:
  - 1. Alarm Supply Co, Inc.
  - 2. Direct Safety Co.
  - 3. Ideal Industries, Inc.
  - 4. LEM Products, Inc.
  - 5. Markal Company
  - 6. National Band and Tag Co.
  - 7. Panduit Corp.
  - 8. Seton Name Plate Co.
  - 9. Thomas and Betts Co.
  - 10. Carlton Industries, Inc.

#### 2.2 LANGUAGE

- A. General: Provide all products in this section in English.

#### 2.3 ELECTRICAL IDENTIFICATION MATERIALS

- A. General: Except as otherwise indicated, provide manufacturer's standard products of categories and types required for each application. Where more than one single type is specified for an application, selection shall be at the installer's option, however, provide a single selection for each application.
- B. Conduit System Markers: Provide manufacturer's standard pre-printed, flexible, permanent, conduit markers, extending 360 degrees around conduits. Markers shall be designed for attachment to conduit by adhesive, adhesive lap joint, matching adhesive plastic tape at each end of marker, or pretensioned snap-on. Color shall match system printing requirements.
- C. Voltage Marking: Except as otherwise indicated, provide lettering which indicates voltage of the conductor(s) in conduit. Provide 4 inch minimum length with 7/8 inch minimum lettering for 2 inch and smaller conduit. Provide 8 inch minimum length with 1-1/4 inch minimum lettering for larger than 2 inch conduit. Provide one marker for each 20' section of conduit. Color shall match system printing requirements.

- D. Plasticized Tags: Manufacturer's standard preprinted or partially preprinted accident prevention and operation tags, of plasticized card stock with matt finish suitable for writing, approximately 3-1/4 x 5-5/8 inch, with brass grommets and wire fasteners, and with appropriate pre-printed wording including large size primary wording, e.g., DANGER, CAUTION, DO NOT OPERATE.
- E. Baked Enamel Danger Signs: Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 gauge steel; of standard red, black and white graphics; 14 x 10 inch size except where 10 x 7 inch is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording, and subsequent directive e.g. HIGH VOLTAGE, KEEP OUT; BURIED CABLE, DO NOT DIG; LIVE PARTS, DO NOT TOUCH SWITCH.
- F. Engraved Plastic Laminate Nameplates: Provide engraving phenolic plastic laminate, in sizes and thicknesses indicated, engraved with 1/16 inch thick lines with square standard pica lettering and wording as specified herein, black face and white core plies (letter color) for normal systems, kelly green and white for equipment, bright orange and white for critical, bright yellow and black for life safety, and red and white for fire alarm and where noted in the specifications. Punch for mechanical fastening, except where adhesive mounting is necessary because of substrate. Material thickness shall be 1/16 inch. Provide beveled edge in order to eliminate sharp corners. Provide self-tapping stainless steel round head screws. Provide contact type permanent adhesive where screws cannot or shall not penetrate the substrate. Adhesive nameplate shall be permanently installed. Titles shall be 1/2 inch high and all other lettering shall be 1/4 inch high.
- G. Junction Box Identification: Provide neat indelible felt tip, stenciled marking on junction box and pullbox covers indicating panel and circuit numbers contained in the box. Letter sizes shall be 1 inch high minimum. Provide non-stenciled markings inside the junction box and on the exterior edge to match the cover markings.

## 2.4 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations, and other designations used in electrical identification work, with corresponding designations specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by the manufacturer and as required for proper identification and operation/maintenance of the electrical system equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.
- B. Size: System identification labeling consists of providing minimum 1/2 inch high stenciled black letters for raceway systems.

## PART 3 - EXECUTION

### 3.1 APPLICATION AND INSTALLATION

- A. Installation: Install electrical identification products as indicated, in accordance with manufacturer's written instructions, as required by the NEC and as specified herein.

- B. Coordination: Where identification is to be applied to surfaces which require a field finish application, install identification after completion of such application.
- C. Regulations: Comply with governing regulations and requests of governing authorities for the identification of electrical work.
- D. Hazards: Identify all rooms, spaces, and equipment that house potential electrical hazards, and label with appropriate signage or indicators.

### 3.2 RACEWAY SYSTEM IDENTIFICATION

- A. Color Coding: All electrical conduit shall be identified by color-coding. Apply color-coded identification on electrical conduit in a neat and workmanlike manner. Utilize a stencil for application of paint.
- B. Identification: Identify all raceways provided or utilized as part of this project as follows;
  - 1. Apply bands 10 feet on center along the raceway system and at each side of walls or floors, and at branches from mains.
  - 2. Identify the following services:

	Service	Label
a.	Low Voltage	120/208 Voltage
b.	Fire Alarm	Fire Alarm
c.	Telephone	Telephone
d.	Computer	Computer
e.	Telephone/computer	Telephone/computer

#### 3. Spot Painting on Rough-in:

- 4.
  - a. Conduit, raceways, boxes, backboxes, panelboards, etc. shall be spot painted. Conduit shall be identified within 6 inches of the box or enclosure. The entire box and coverplate shall be painted.
  - b. Use following colors for color bands and for color coding:

	System	Color
(1)	Normal Power	Royal Blue
(2)	Emergency Power	Purple
(3)	Miscellaneous Communications	Brown
(4)	Fire Alarm	Red
(5)	Telephone\Computer	Black

### 3.3 CABLE/CONDUCTOR IDENTIFICATION

- A. General: Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where conductors of more than one circuit or communication (such as color coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for the project's electrical work.
- B. Color Coding: Color code all power and lighting cable. Use wire colored by integral pigmentation, making the wire 100 percent colored. Where not practicable or available (in larger conductor sizes), color code the wire by using colored plastic tape, painting the ends accessible at junction or pull boxes, or other method acceptable to the Engineer. Use the following chart as applicable

### 3.4 OPERATIONAL IDENTIFICATION AND WARNINGS

- A. General: Provide identification and warning wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems. Provide identification and warning identification if necessary for signage to help prevent misuse of electrical facilities by unauthorized personnel.
- B. Plasticized signs: Install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes.
- C. Locations: In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified as constituting dangers for persons in or about the project.
- D. High Voltage: Install danger signs wherever it is practicable, for persons to come into contact with electrical power of voltages 208 volts to ground or higher.
- E. Critical Switches/Controls: Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.
- F. Electrical Equipment Rooms: Provide warning signage at the entrance to each such room; identify the hazard, and direct non-qualified personnel to stay away.
- G. Equipment Identification:
  - 1. Nameplates: Install an engraved phenolic plastic laminate nameplate on each unit of electrical equipment in the building, including central or master unit of each electrical system unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text. Provide text matching terminology and numbering of the contract documents and shop drawings.
  - 2. Locations: Provide nameplates for each unit of the following categories of electrical work:

- a. Panelboards, electrical cabinets, and enclosures.
    - (1) Provide a nameplate outside above the door (if equipped with one) listing its designation, voltage, source and circuit number.
  - b. Access panel/doors to electrical facilities.
  - c. Motor starters.
  - d. Disconnect switches.
  - e. Enclosed circuit breakers.
3. Viewing: Install nameplates at locations indicated and where not otherwise indicated at a location for the best convenience of viewing without interference with operation and maintenance of equipment.
- a. Secure to substrate with rigid fasteners. Utilize adhesive where fasteners cannot penetrate substrate.
4. Names: The names or wording used for a particular machine shall be the same as the one used on all motor starters, disconnects and remote button stations nameplates for that machine.

END OF SECTION 26 05 53

## SECTION 262413 – DISTRIBUTION SWITCHBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

#### 1.2 DESCRIPTION

- A. Description of System: Provide factory-assembled, metal-enclosed switchboard for service entrance from line terminals to outgoing feeder terminals, complete, installed, and tested in place.
- B. General: Switchboard shall include all main and branch protective devices, related equipment as required or as listed on drawings, with all necessary interconnections, instrumentation, control wiring, etc.

#### 1.3 DISTRIBUTION SWITCHBOARDS QUALITY ASSURANCE

- A. ANSI: The latest edition of the Reference Standards for the American National Standards Institute shall apply as follows;
  - 1. ANSI Y32.2 - Graphic Symbols for Electrical and Electronic Diagrams.
  - 2. ANSI Z55.1 - (R1973) Gray finishes for Industrial Apparatus and Equipment.
  - 3. ANSI C57.13 - Instrument transformers
- B. NEMA: National Electrical Manufacturers Association shall apply as follows;
  - 1. NEMA PB2, Dead front Switchboards.
  - 2. NEMA AB1, for molded case circuit breakers and switches.
  - 3. NEMA MS1 for enclosed switches.
- C. NFPA: The latest edition of the National Fire Protection Association shall apply as follows;
  - 1. NFPA 70, National Electrical Code (NEC).
  - 2. Refer to Section 16010 for additional references.
- D. UL: The latest edition of the Underwriters' Laboratories, Incorporated shall apply as follows;
  - 1. UL Electrical Construction Materials List Switchboards-dead front type (384 W4) WEVZ.
  - 2. UL 891-Dead front switchboards.
  - 3. UL 50 Cabinets and boxes.
  - 4. UL 38 Enclosed and dead front switches.
  - 5. UL 489 Molded case circuit breakers.
  - 6. UL 891 Dead front switchboards.
  - 7. UL 943 Ground fault circuit interrupters.

8. UL 977 Fused power circuit breakers

- E. Source Quality Control: Tests to meet NEMA PB2 requirements.
- F. Design Tests: Rated Continuous current test, short circuit current test, Enclosure test, Dielectric test.
- G. Production Tests: Perform tests on completed switchboard assembly.
- H. Type: Dielectric tests, Mechanical operation test, Grounding tests, Control wiring tests, Electrical operation tests.

1.4 SUBMITTALS - DISTRIBUTION SWITCHBOARDS

- A. General: Submit layouts showing concrete pad dimensions, conduit entrance and available space, bus duct connections, electrical rating, nameplate nomenclature, single-line diagram (in accordance with ANSI Y32.2) indicating all connections and control.
- B. Shop Drawings: Shop Drawings shall be submitted for each switchboard and shall clearly indicate all of the following information;
  - 1. Enclosure elevations, studs and details.
  - 2. Complete Construction Information
  - 3. U.L. Label
  - 4. Each overcurrent device amperage rating, circuit number and position/location in the switchboard.
  - 5. Electrical characteristics
  - 6. Dimensions, (width, depth, height, weight)
  - 7. Switchboard classification
  - 8. Frame size, rating and interrupting capacity of each breaker, and of total assembly.
  - 9. Horsepower rating at rated voltage of fused switches and/or breakers.
  - 10. Size and type of fuses being provided.
  - 11. Ranges of all meters (all meters shall be analog).
  - 12. Type of labeling for each overcurrent device and load (Provide at least one sample with shop drawing).
  - 13. Main switchboard nameplate indicating project name; Architect, Engineer and Contractor.
  - 14. Product data for switchboard mounted transformers; transfer switches; main fused "bolt-loc" switches; power breaker; or other specialties clearly and/or separately called out in the contract documents.
  - 15. Bus bar size, type arrangement and spacing (Phase, neutral and ground bar).
  - 16. Transparency log paper time current curves for protective relays, current and potential transformer excitation and saturation curves, and fuses.
  - 17. Protective relay instruction books.
  - 18. Shipping sections.
  - 19. Lug sizes for cables on all switches or breakers.
  - 20. Incoming lug sizes.
- C. Product Data: Manufacturer's written recommendations for storage, protection, handling, installation instructions and field test requirements. Record all field tests, itemize data and submit at end of project with project manual.



- D. Test Reports: Reports of production and field tests.
- E. Operations and Maintenance Data: Provide and comply with manufacturer's instructions for tightening bus connections, performing cleaning, operating and maintaining switchboard.

#### 1.5 QUALITY ASSURANCE

- A. Standards: The switchboard shall comply with the latest edition of the following standards:

- 1. American National Standards Institute (ANSI):
  - a. ANSI Y32.2, Graphic Symbols for Electrical and Electronic Diagrams.
  - b. ANSI Z55.1 (R1973) Gray finishes for Industrial Apparatus and Equipment.
  - c. ANSI C37.20 Switchgear assemblies.
- 2. National Electrical Manufacturers Association (NEMA):
  - a. NEMA PB2, Dead front Switchboards.
  - b. NEMA SG5, Power Switchgear assemblies.
- 3. National Fire Protection Association (NFPA).
  - a. NFPA 70, National Electric Code (NEC).
- 4. Underwriters' Laboratories, Incorporated (UL).
  - a. UL Electrical Construction Materials List, Switchboards-dead front type (384 W4) WEVZ.
  - b. UL 891-Dead front switchboards.

- B. Source Quality Control:

- 1. Tests to meet NEMA SG5 and PB2 requirements.
- 2. Design Tests:
  - a. Rated Continuous current test.
  - b. Short circuit current test.
  - c. Enclosure test.
  - d. Dielectric test.
- 3. Production Tests:
  - a. Perform tests on completed switchboard assembly.
  - b. Type:
    - (1) Dielectric tests.
    - (2) Mechanical operation test.
    - (3) Grounding tests.
    - (4) Control wiring tests.
    - (5) Electrical operation tests.

## 1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handling: Only lift switchboard using eyes, yokes, and skids provided by manufacturer.
- B. Storage: Do not store indoor switchboard exposed to weather.
- C. Protection: Physically protect switchboard against all damage. Cover switchboard with suitable material to avoid damage to finish.

## PART 2 - PRODUCTS

### 2.1 DISTRIBUTION SWITCHBOARDS

- A. General: Switchboards shall be deadfront with front accessibility required. The switchboard frame shall be of formed code gauge steel rigidly bolted together to support all coverplates, bussing and component devices during shipment and installation. Steel base channels shall be bolted to the frame to rigidly support the entire shipping section for moving on rollers and floor mounting. Each switchboard section shall have an open bottom and an individually removable top plate for installation and termination of conduit. All front covers shall be screwed on and removable and all doors shall be hinged with removable hinge pins. Top and bottom conduit areas shall be clearly indicated on shop drawings. Switchboards shall be freestanding and completely self supporting structures, 90 inches high.

### 2.2 BUSSING AND TERMINATIONS

- A. Bus bars: Buses shall be plated copper sized on the basis of not more than 800 ampere per square inch current density. Bussing shall be of sufficient cross-sectional area to meet UL Standard 891 temperature rise. The bus structure shall be braced and rated to withstand mechanical forces exerted during short circuit current conditions when connected directly to a power source having a minimum 50,000 rms symmetrical amperes. A ground bus shall be provided and factory secured to each vertical section of switchgear.
- B. Bus Supports: All bus supports, connections and joints shall be bolted with hex-head bolts and Belleville washers to minimize maintenance requirements.
- C. Accessibility: Bus connections shall be front accessible. Each switchboard end section shall include all provisions for the addition of future sections.
- D. Space Provisions: Where space for future is called for on drawings, provide all necessary hardware and bus, except device connecting straps.
- E. Ratings: Switchboard through bus shall have continuous current rating of 100 percent of main device frame size.
- F. Terminations: All line and load termination points shall be suitable for the quantity and size of terminated conductors as indicated on the drawings and shall be suitable for each type of conductor material. Terminations shall be front accessible.
- G. Hardware: All hardware shall be manufactured from high tensile strength steel and have a suitable protective finish.

- H. Bus Duct Connections: When bus duct stubs are required, they shall be suitable for direct connection from the switchboard to the bus duct without any cabling connections.

## 2.3 MAIN SECTION

- A. General: The main service and tie breaker disconnect devices shall be as specified herein and shall be totally front accessible and front connectable.

## 2.4 DISTRIBUTION SECTIONS

- A. General: Group mounted molded case circuit breakers, fusible switches, or integrally fused circuit breakers shall be totally front accessible. The branch protective devices are to be mounted in the switchboard to permit easy installation, maintenance and testing without reaching over any line side bussing. The circuit breakers shall be removable by the disconnection of only the load side cable terminations and all line and load side connections shall be individual to each circuit breaker. No common mounting brackets or electrical bus connectors will be acceptable. Each circuit breaker is to be provided with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.

## 2.5 SWITCHBOARD CONSTRUCTION

- A. General: Switchgear shall comply with ANSI 37.20 and NEMA SG-3 and SG-5 as a minimum requirement. Switchgear shall be NEMA Class III Type I construction and shall meet Underwriters' Laboratories enclosure requirements for service conditions. Switchgear shall comply with NEMA SG-3, SG-4 and SG-5 as a minimum requirement. Each cubicle shall have U.L. Label affixed, unless special construction prohibits and no labeling or listing is available. The sides and tops shall be covered with removable screw-on code gauge steel plates. Switchgear shall be completely self supporting structures, 90 inches high.
- B. Finish: All steel surfaces shall be chemically cleaned and treated to provide a bond between paint and metal surfaces to help prevent the entrance of moisture and formation of rust under the paint film. The switchgear exterior shall be finished in indoor light grey No. 61, ANSI Z55.1. Apply corrosion-protective undercoating to undersurfaces.
- C. Bussing and Terminations: Bus bars - Buses shall be tin or silver plated copper sized on the basis of not more than 1000 ampere per square inch current density. The bus structure shall be braced to withstand mechanical forces exerted during short circuit conditions when connected directly to a power source having minimum 100,000 amperes symmetrical short circuit current. A ground bus shall be provided secured to each vertical section structure. Comply with the following:
  - 1. Bus connections shall be accessible from rear.
  - 2. Where space for future is called for on drawings, provide a fully bussed cubicle complete with wiring harness, door cut-outs blanked off, breaker carriage and bus/breaker stabs.
  - 3. Where provisions for future sections are called for on drawings all buses shall be extended to last section and be adaptable for extension.
  - 4. Thru bus that feeds additional sections to main section shall have continuous current rating of 100 percent of rating of main device frame size.

5. Line and load terminations shall be provided suitable for the size, number of conductors, and conductor material. Terminations shall be accessible from the front.
  6. Provide full-height hinged doors on back and cubicle height doors on front of all cubicles. Devices may be mounted in front doors and doors may be divided in sections as required for easy access to equipment.
  7. All hardware shall have high tensile strength, and have a suitably protective finish.
  8. Where bus ducts are called for on drawings, bus duct stub shall be suitable for direct connection to bus duct without cabling.
- D. Accessories: Switchgear shall be provided with adequate lifting means, and shall be capable of being rolled or moved into installation position and bolted directly to the floor without the use of floor sills. The switchgear manufacturer shall provide one set of accessories for test, inspection, maintenance and operation.

## 2.6 MANUFACTURERS

- A. Manufacturer: Basis of design is Square D.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Preparation: Examine area to receive switchboard to assure that there is adequate clearance to meet NEC requirements and normal maintenance issues for switchboard installation. Check that housekeeping pads (concrete base) are level and free of irregularities. Start work only after any unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Compliance: Provide switchboard complete in accordance with manufacturer's written instructions, NEC, and all applicable codes.
- B. Mounting: Mount switchboard on 4 inch housekeeping pad (concrete base). Pad shall extend 4 inches beyond switchboard edge on all sides with all equipment installed.
- C. Mats: Provide continuous rubber insulating mat on floor in front of switchboard. Mat shall extend for the entire length of switchboard plus two feet beyond each side. Mat to be minimum 4 feet wide and 1/2 inch thick. Mat shall lie flat on floor without the use of any adhesive or fastener. Entire edge of mat shall be chamfered. Submit manufacturer's data sheet and sample of mat with shop drawings.

### 3.3 FIELD QUALITY CONTROL

- A. General: Provide field tests prior to energization as follows;
1. Megger check and record all data, of phase to phase and phase to ground insulation levels.
  2. Continuity.
  3. Short Circuit.
  4. Proper phase relationship.

- B. Provisions: Perform tests according to switchboard manufacturer's instructions.

### 3.4 ADJUSTMENT AND CLEANING

- A. Adjustments: Adjust operating mechanisms for free mechanical movement.
- B. Connections: Tighten bus connections and mechanical fasteners.
- C. Finish: Touch-up scratched or marred surfaces to match original finish.

### 3.5 CHECK-OUT MEMO

- A. General: Submit check-out memo from switchboard representative.

END OF SECTION 26 2413

### CHECK-OUT MEMO

NOTE TO CONTRACTOR: Do not submit this form at the time Technical Information Brochure is submitted. This form shall be completed and submitted before Instruction in Operation to Owner or a request for final inspection.

Name of equipment checked:\_\_\_\_\_

Name of manufacturer of equipment:\_\_\_\_\_

Re: \_\_\_\_\_  
(Name of Project)

1. The equipment furnished by us has been checked on the Job by us. We have reviewed (where applicable) the performance verification information submitted to us by the Contractor.
2. The equipment is properly installed, except for items noted below.\*
3. The equipment is operating satisfactorily, except for items noted below.\*
4. The written operating and maintenance information (where applicable) has been presented to the Contractor, and gone over with him in detail. Five (5) copies of all applicable operating and maintenance information and parts lists have been furnished to him for insertion in each of the Equipment Brochures.

Checked by: \_\_\_\_\_  
(Printed Name of Manufacturer's Representative)

\_\_\_\_\_  
(Address and Phone No. of Representative)

\_\_\_\_\_  
(Signature and Title of Person Making Check)

\_\_\_\_\_  
(Date Checked)

cc: Owner, Architect, Engineer, Contractor and Subcontractor

\*Exceptions noted at time of check were as follows:

## SECTION 262416 – PANELBOARDS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

#### 1.2 DESCRIPTION

- A. Description: Provide panelboards with main breaker or main lugs where shown on the drawings, of a dead front, distributed phase sequence design. Panelboards shall be equipped with thermal-magnetic molded case circuit breakers with frame and trip ratings as indicated in the schedules.

#### 1.3 QUALITY ASSURANCE

- A. ANSI: the latest edition of the Reference Standards for the American National Standards Institute shall apply as follows;
  - 1. ANSI Y32.2 - Graphic Symbols for Electrical and Electronic Diagrams.
  - 2. ANSI Z55.1 - (R1973) Gray finishes for Industrial Apparatus and Equipment.
- B. NEMA: National Electrical Manufacturers Association shall apply as follows;
  - 1. NEMA PB1-1984 Panelboards
  - 2. NEMA PB1-57 Gutter space
- C. NFPA: The latest edition of the National Fire Protection Association shall apply as follows;
  - 1. NFPA 70, National Electrical Code (NEC).
- D. UL: The latest edition of the Underwriters' Laboratories, Incorporated shall apply as follows;
  - 1. UL Electrical Construction Materials List, panelboards-dead front type.
  - 2. UL 67 Panelboard wiring gutter space, bus heat rise test.
  - 3. UL 50 Cabinets - Rigidity and gauge of steel.
- E. Listing: Panelboards shall be listed by Underwriters Laboratories and bear the UL or other nationally recognized testing laboratory label. Where required, panelboards shall be listed for use as service entrance equipment.

#### 1.4 SUBMITTALS

- A. Shop drawings:

1. Product data shall be submitted on:
  - a. Panel
  - b. Cabinet
  - c. Bus
  - d. Construction
  - e. Dimensions
2. Shop drawings shall be submitted for every panel, and shall clearly indicate all of the following information:
  - a. U.L. Label
  - b. Each circuit breaker amperage rating, circuit number and position/location in panel
  - c. Electrical characteristics of panel
  - d. Main bus rating
  - e. Main device rating
  - f. Mounting type
  - g. Dimensions, (width, depth, height, weight)
  - h. Bus material
  - i. Interrupting capacity of minimum rated breaker
  - j. Panelboard classification
  - k. Submit coordination curves on log-log paper for all breakers, fuses, transformers, etc.
  - l. If dimensions for equipment proposed in submitted shop drawings are different than was shown on drawings, contractor shall submit sketches showing layout of proposed equipment.
3. Coordination Study: The Contractor shall expect an additional 10 working days for panelboard and switchboard review to allow the Engineer to design the coordination study.

#### 1.5 OVERCURRENT PROTECTIVE DEVICES - DESCRIPTION

- A. Description of System: Connections of all items using electric power shall be included under this division of the specifications, including necessary wire, conduit, circuit protection, disconnects and accessories. Securing of roughing-in drawings and connection information for equipment involved shall also be included under this division. See other divisions for specifications for electrically operated equipment. Provide overcurrent protection for all wiring and equipment in accordance with the NEC, all federal, state and local codes as required and/or as shown on the drawings.

#### 1.6 OVERCURRENT PROTECTIVE DEVICES - SUBMITTALS

- A. Shop drawings and product data: Shop drawings shall clearly indicate;
  1. Frame sizes and interrupting capacity of all circuit breakers.
  2. Horsepower ratings of rated voltage of fused switches and/or circuit breakers.
  3. Size and type of fuses being provided.
  4. Device is U.L. Listed, and bears the U.L. Label.



5. Device complies with these specifications, drawings, and applicable standards of NEMA, IEEE, ANSI, and ASA.

## PART 2 - PRODUCTS

### 2.1 PANELBOARDS

- A. Equipment: The panelboard bus assembly shall be enclosed in a steel cabinet and shall be surface or flush mounted as shown in the schedules. The box shall be fabricated from galvanized steel with standard baked enamel finish. Panelboard front shall include a door and shall have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboard locks shall be keyed alike. All panel cabinets shall be a minimum of 20 inches wide. Fronts shall have adjustable indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Panel front shall not be removable with door in the locked position.
- B. Bus: Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule. Bus shall be insulated and bus bar connections to the branch circuit breakers shall be of the "distributed phase" or phase sequence type. All current carrying parts of the bus structure shall be tin plated copper. A full size insulated neutral bus bar shall be provided. Provide system grounding tin plated copper bus bar bonded to the panelboard cabinet for connection of system grounding conductors. This bar shall be mechanically and electrically isolated from the neutral bar except where panelboard is used as service entrance equipment.
- C. Molded Case Circuit Breakers: All panelboard branch circuit breakers shall be bolt-on thermal-magnetic molded case type. Breakers shall be 1, 2 or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multi-pole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and active handle indication. Handles shall have "ON", "OFF", and "TRIPPED" positions. Bolt-on circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware.
- D. 120/208 Rating: 120/208 volt circuit breakers shall have interrupting ratings a minimum of 10,000 rms symmetrical amperes at 240 volts AC maximum, refer to drawings for specific ratings.
- E. Switching Type: Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.
- F. Directories: A typed panelboard directory shall be provided for each panelboard and shall indicate the actual circuit number used, room name and type of load. Room names shall be the actual name or room number used not necessarily as shown on the drawing. Panel directories shall include all room numbers and names. Where panel schedules are indicated on the drawings as "receptacles or "lighting", etc., it shall be the responsibility of the Contractor to include the specific area served.
- G. Bracing: Panelboard as a complete unit shall be braced for a minimum short circuit rating equal to or greater than the lowest breaker symmetrical interrupting capacity as shown on the schedule.

- H. Grounding: All panelboard cabinets shall have a system grounding bar bonded to the panelboard cabinet for connection of system grounding conductors. This bar shall be mechanically and electrically isolated from the neutral bar.
- I. Stubs: Provide four 3/4 inch conduits from all flush mounted panels to adjacent accessible ceiling space and mark "for future use". Provide pull cord in all empty conduits and provide plastic end bushing.
- J. Design Selection:

120/208V

480/277V

Square "D", NQOD  
Cutler-Hammer: Pow-R-Line 1  
General Electric: A-Series  
Siemens: S1 Series

Square "D", NF Series  
Cutler-Hammer: Pow-R-Line 2  
General Electric: A-Series  
Siemens: SL/SE Series

600A

thru

1200A

Square "D": I-Line  
Cutler-Hammer: Pow-R-Line 4  
General Electric: Spectra Series  
Siemens: S4/S5 Series

Square "D": I-line  
Cutler-Hammer: Pow-R-Line 4  
General Electric: Spectra Series  
Siemens: S4/S5 Series

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. General: Examine area to receive panelboard and assure that there is adequate clearances to meet NEC requirements and normal maintenance issues.
- B. Correction: Start work only after any unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Provide panelboards in complete accordance with manufacturer's written instructions and all applicable codes.
- B. Support: Panelboards shall be rigidly supported and installed per manufacturers recommended supporting instructions, with beams provided if necessary, to suit actual site conditions. Panels shall not be directly mounted to masonry walls. Use kindorf or similar channel.
- C. Storage and Delivery: Panelboards shall be delivered to the site during that phase of panelboard installation in order to avoid storing panels on site where damage may occur. Replace any damaged parts prior to energizing panel. Cover panelboard to avoid damage to finish.
- D. Mounting: Do not mount equipment directly to masonry or concrete walls. Provide two uni-strut spacers between wall and panelboard.

- E. Operations and Maintenance Data: Manufacturer's instructions for tightening bus connections, cleaning, operation and maintenance.

### 3.3 QUALITY CONTROL

- A. General: Field test prior to energization;
  - 1. Megger check, and record all data, of phase to phase and phase to ground insulation levels.
  - 2. Continuity.
  - 3. Proper phase relationship.

### 3.4 CHECK-OUT MEMO

- A. General: Submit check-out memo from panelboard representative.

END OF SECTION 26 24 16

## SECTION 262420 – SAFETY SWITCHES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified of this section.

#### 1.2 QUALITY ASSURANCE

- A. General: Switches and all components shall be manufactured and tested in accordance with the latest applicable standards of NEMA and UL.

#### 1.3 SUBMITTALS

- A. Shop drawings: Product data shall be submitted on:
  - 1. Switch rating, including voltage, continuous current, short-circuit.
  - 2. Fuse ratings, when applicable.
  - 3. Cable terminal sizes.
  - 4. Enclosure type.
  - 5. Conduit entry/exit locations.

### PART 2 - PRODUCTS

#### 2.1 HEAVY DUTY SAFETY SWITCHES

- A. General: All disconnect switches shall be heavy-duty type, unless specifically noted otherwise. Switches shall be fusible or non-fusible and sized as noted on the drawings. Provide units manufactured by Siemens, GE, Square D or Cutler Hammer.
- B. Switches shall be 240 volt rated on systems up to and including 120/240V. All switches serving motor loads or shall be horsepower rated.
- C. Provide NEMA 1 enclosure, unless otherwise noted. All switches mounted outdoors shall be NEMA Type 3R or as noted NEMA Type 4X, stainless steel.
- D. Provide lugs on disconnect switch as required to accept conductors called for on drawings.
- E. Provide switches with an externally operated handle; quick make quick break mechanism; the handle shall be interlocked with the switch cover by means of a defeatable interlock device. The switch shall be lockable in the "off" position with a padlock.

- F. Switches shall have arc suppressors and pin hinges. Switch blades shall be readily visible in the OFF position. Switch blades and jaws shall be plated copper. Provide with line side terminal shields.

## 2.2 FUSES

- A. General: All fuses shall be of the same manufacture to retain selectability as designed. No fuse shall be installed until equipment is ready to be energized and after tightening of all electrical connections, inspection of all ground and grounding conductors and a megger test of adequate insulation to ground of all circuits.
- B. Current Limiting: All fuses shall be current-limiting with 200,000 amperes interrupting capacity.
- C. 601 Amps and Above: Fuses rated 601 amperes and larger shall be UL Class L and have a minimum time-delay of 45 seconds at 300% rating and have O-ring gas seals at the end bells.
- D. 600 Amps and Below: Fuses rated 600 amperes or less, installed ahead of circuit breakers or circuit breaker panels, shall be UL Class K-1. Fuses rated 600 amperes or less for all general power circuits shall be dual-element, UL Class K-5 time-delay type. They shall be self protecting from extraneous heat.
- E. Motor Circuits: Fuses installed in individual motor circuits shall be dual element time-delay type, UL Class K-5. Use fuse reducers when fuse clip spacing is larger than the fuse dimension.
- F. Rejection Fuses: Fuses called for to be rejection type are to have rejection fuse holders.
- G. Identification Label: A fuse identification label, showing type and size, shall be placed inside the door of each fused switch. Labeling for rejection type fused switches shall read "Warning-Use Only Current Limiting Fuses Class \_\_\_\_ , Type \_\_\_\_ , MFR \_\_\_\_ ," engraved in red laminated plastic.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. General: Examine area to receive safety switch and assure that there is adequate clearances to meet NEC requirements and normal maintenance issues.
- B. Correction: Start work only after any unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Provide safety switches in complete accordance with manufacturer's written instructions and all applicable codes.

- B. Support: Switches shall be rigidly supported and installed per manufacturers recommended supporting instructions. Switches shall not be directly mounted to masonry walls; Use Kindorf, uni-strut or similar support.
- C. Storage and Delivery: Safety switches shall be delivered to the site during that phase of installation in order to avoid storing switches on site where damage may occur. Replace any damaged parts prior to energizing. Cover to avoid damage to finish.
- H. Operations and Maintenance Data: Manufacturer's instructions for tightening connections, cleaning, operation and maintenance.

### 3.3 ADJUSTMENT AND CLEANING

- A. General: Adjust operating mechanisms for free mechanical movement.
- B. Connections: Tighten lug connections and mechanical fasteners.
- C. Finish: Touch-up scratched or marred surfaces to match original finish.

END OF SECTION 26 24 20

## SECTION 262726 – WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 DESCRIPTION

- A. General: Provide factory fabricated wiring devices in type, color and electrical rating for the service indicated to provide convenient access to the electrical system for portable and permanent connections, and control of fixed outlets.
- B. Ratings: Voltage and ampere rating of switches and receptacles shall be marked on the device, and shall conform to Voltage and Ampacity of system to which applied.
- C. Hardware: Devices consist of all the necessary hardware to complete an installation and provide a margin of safety by inaccessibility of live electrical components.

#### 1.3 RECEPTACLES AND SWITCHES QUALITY ASSURANCE

- A. Manufacturers: Manufacturers shall be companies regularly engaged in manufacture of wiring devices, of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years. Acceptable manufacturers are Pass & Seymour, Hubbell, and Leviton Manufacturing.
- B. Installer: A firm with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for the project.
- C. Compliance: Comply with the latest edition of the following standards;
  - 1. NEMA WD1, WD3 and WD5
  - 2. UL 5, 20 and 231
  - 3. ANSI/IEEE Standard C62.41-1980 (Formerly IEEE 587)
    - a. Test withstand voltage surges of up to 6000 volts and current surges of up to 200 amperes without damage.
- D. Warranty: Provide a minimum one-year warranty from time of final acceptance.

#### 1.4 SUBMITTALS

- A. Wiring Devices: Submit manufacturer's product data on all wiring devices listed on the drawings including;

1. Colors
2. Dimensions
3. U.L. Label
4. Finish
5. Voltage
6. Wiring diagrams
7. Application information

- B. Coverplates and Identification: Submit type of identification used for coverplates to comply with the Identification Section as specified herein. Screws to match coverplate color.

## 1.5 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of all wiring devices.

## PART 2 - PRODUCTS

### 2.1 CONVENIENCE RECEPTACLES

- A. Twenty Ampere Receptacles: Provide commercial specification grade single or duplex receptacles, 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20 ampere, 120 volts, with metal plaster ears, side wiring, NEMA configuration 5-20R unless otherwise indicated.
- B. Color: Devices connected to the normal system shall be white in color, unless otherwise noted.
- C. Device Type: Unless otherwise noted, in all public areas, provide all receptacles as the duplex modular type. Provide standard devices in non-public areas such as storage rooms, janitor's closet, penthouses & mechanical spaces, and electrical rooms.
- D. Construction: Heavy duty nylon face and wraparound mounting strap, locked into and on the body, utilizing heavy-gauge brass ground contacts riveted to strap. Include automatic self-grounding spring to assure ground continuity between mounting strap and metal wall box. T-slot one piece copper alloy contact wipes which interface with plug blades inserted at 3 points. Line terminals shall be screw terminals and accept #14 to #10 AWG copper conductors.
- E. Manufacturer: Manufacturer shall be Pass & Seymour, Leviton or Hubbell.

Pass & Seymour		Leviton		Hubbell	
P/S 15A	P/S 20A	15 A	20A	15 A	20A



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## 2.2 SWITCHES

- A. Toggle Switches Rocker Style: Provide specification grade, fast-make positive-break, flush single-pole, three and four way, silent operation toggle switches, 20 ampere, 120 volt AC with mounting yoke insulated from mechanism, equipped with plaster ears, and side-wired screw terminals.
- B. Two Pole Switches: Provide two pole switches where drawings indicate the switching of 208 volt systems consisting of two phase conductors.
- C. Security Key Switches: Provide key switches where drawings indicate, where a degree of security requires limited access to control of the lighting system.
- D. Pilot Light Handle: Handle glows when switch is on. Handle color shall be clear, unless otherwise indicated.
- E. Thermal Switch: Provide fractional horsepower switch with melting alloy type overload relay, with number of poles to coordinate with the equipment being controlled. Surface or flush mounted cover, as required, equipped with padlocking device and pilot light. Provide overload relay heaters for each pole of the switch, sized per the manufacturer's instruction, and adjust heater size to permit normal operation of the motor.
- F. Color: Match receptacle devices.

## 2.3 PLUGS AND CONNECTORS

- A. Standard: Comply with NEMA Standards Pub. No. WD1.

## 2.4 WIRING DEVICE ACCESSORIES

- A. Faceplates: Unless otherwise noted, provide smooth faced nylon, single and ganged switch, receptacle, telephone, blank and other outlet wall plates for wiring devices, with ganging and cutouts as required
- B. Multigang: Provide all necessary hardware and frames to properly mount various devices in combinations.
- C. Exterior Device Covers: Provide "Weatherproof" duplex with stainless steel hinged cover. Device opening shall be standard or modular, to be compatible with the device provided for elsewhere in these specifications.
- D. Color: Unless otherwise noted, provide colored faceplates to match devices listed elsewhere in these specifications.

## 2.5 PRODUCT DESIGN SELECTION

- A. Standard Commercial Specification Grade Receptacles: Provide standard commercial specification grade receptacles as follows;

Description	Leviton	Hubbell	P & S
20 amp Simplex	#5801	#5351	#5351
20 amp Duplex	#CR20	#CR20	#5342
20 amp Duplex GFCI	#6898	#GF-5352	#2091-S
20 amp Duplex Isolated Gnd.	#5362-IG	#IG-5362	#IG-6300
20 amp Duplex TVSS	#5380	#5352-IS	#6362-SP

- B. Motor Starter Switches: Provide motor starter type switches as follows;

Description	Square D
Manual motor starter switch with overloads	Class 2510
Manual motor starter switch with overloads and pilot light	Class 2510

- C. Device Covers: Provide device covers as follows;

Description	Leviton	Hubbell	P & S
Weatherproof stainless steel coverplate	----	#5221-5222	WP-8
Weatherproof stainless steel coverplate locking type	----	----	SP-26L

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF WIRING DEVICES

- A. General: Provide wiring devices, in accordance with manufacturer's written instructions, applicable requirements of NEC and National Electrical Contractors Associations "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Completion: Delay installation of devices until wiring and wall finish is completed.
- C. Support: Devices shall be securely supported to box, not supported to device plate. Device shall trim out flush with front of plate. Do not support the device by loosening device mounting screws and attaching the coverplate for leveling.

- D. Adjustment: Provide receptacles and switches only in electrical boxes which are clean, free from excess building materials, debris, etc. Adjust devices to plumb when tightened, and in position to receive faceplate. Devices shall not be leveled by using the mounting screws, outlet boxes shall be flush to wall finish prevent leveling problems. Tighten devices and provide securely, so that there shall be no movement during usage.
- E. Position: Position ground pin at the top of the device in vertical application, unless otherwise noted.
- F. Wiring: Provide screw terminal connections using a single conductor only. Do not "back-stab" devices. Provide single whips for all multiple conductor connections within each box.

### 3.2 APPLICATION OF COVER PLATES

- A. Mounting: Provide coverplates in true vertical or horizontal alignment as applicable. Plates shall be properly secured by means of screws which have heads with finish matching the plate. Secure plates so as to maintain a snug fit against wall surfaces with no gaps.
- B. Replacement: Replace all coverplates which are warped, cracked, chipped, or whose color does not match the balance of the installation. Replace screws whose threads do not allow the drawing up tight of the coverplate to the device.

### 3.3 CLEANING

- A. Soiled Devices: Clean devices soiled prior to acceptance inspection, to remove all debris and foreign materials, such as paint, varnish, drywall compound, etc.
- B. Solutions: Do not use liquid cleaning solutions, etc. on the face of the devices without written direction from the Engineer/Architect.

### 3.4 TESTING

- A. Ground testing: Provide ground testing procedures as specified herein. Prior to energizing circuitry, test wiring devices for electrical continuity, and for short circuits.
- B. Polarity: Subsequent to energization, test wiring devices for proper polarity, and to demonstrate operations as required in this and other sections of this Specification.
- C. Recording: Record all tests as required in other sections of this specification.

END OF SECTION 26 27 26

## SECTION 264100 - LIGHTNING PROTECTION

### SYSTEMS PART 1 -GENERAL

#### 1.1 WORK INCLUDED

- A. Comply with the provisions of Section 26 0500.
- B. Provide labor, materials and equipment required for completion of a functional system of air terminals, conductors, grounds, and other components necessary for protection against damage by lightning.
- C. System shall be concealed, with only air terminals and roof conductors visible.

#### 1.2 RELATED WORK

- A. Division 7: Roofing and flashing.

#### 1.3 SUBMITTALS

- A. Submit shop drawings and lists of materials for review.

### PART 2 -PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers:
  - 1. Heary Brothers Lightning Protection, Inc.
  - 2. Thompson Lightning Protection, Inc.
  - 3. Robbins Lightning Protection Company
  - 4. A/C Lightning Security
  - 5. Harger Lightning Protection

#### 2.2 MATERIALS

- A. Materials used shall be new, and manufactured by a member of the Lightning Protection Institute and listed and labeled by U.L.
- B. Conductors, terminals and fittings at roof line shall be aluminum. Components below roof line shall be copper. Conductors shall have the following minimum characteristics:
  - 1. Main Cables:
    - a. Class II: 1) Standed size: Cu-15 AWG; Al-13 AWG. 2) Weight (lbs/1000 feet): Cu-375 lbs; Al-190 lbs 3) Cross Sectional Area; Cu-115,000 CM; Al-192,000 CM
  - 2. Bonding Cables
    - a. Class II: 1) Strand Size: Cu-17 AWG; Al-14 AWG 2) Cross Sectional Area: Cu-26,240 CM; Al-41,740 CM

- C. Air terminals shall be five-eighths inch (5/8 in.) diameter for Class II, solid aluminum rods with tapered point. Length of rods shall vary as shown on drawings but shall be not less than ten inches (10 in.).
- D. Ground rods shall be three-quarter inch (3/4 in.) by ten feet (10 ft.) copper.
- E. Fittings for mounting air terminals, for bonding and for securing cables to the roof shall be compatible with the type cables employed. Provide fittings designed for the purpose where aluminum and copper cable are connected one to the other.
- F. Flashing boots and penetration seals required for installation through or on the roof shall be furnished under other Divisions.

### PART 3 -EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Completed system shall conform to the requirements of NFPA 780 (2004 edition) and UL Standard 96A.
- B. Metal bodies of inductance located above the roof, such as metal flashings, gravel stops, roof drains, plumbing vents, louvers and door frames, shall be connected to the lightning protection system if situated within six feet (6 ft.) of a lightning conductor or another bonded metal body.
- C. Fittings secured by adhesive shall be set in place with adhesive before roof gravel is applied.
- D. Do not install copper lightning protection materials on aluminum surfaces nor aluminum materials on copper surfaces.
- E. Install the system to blend with the appearance of the building, neat and inconspicuous.
- F. Seal exposed ends of conduits with a sealer to prevent moisture penetration.

#### 3.2 CONDUCTOR INSTALLATION

- A. Do not bend a conductor in a radius of less than eight inches (8 in.) nor allow it to form an included angle of less than ninety degrees (90 degrees).
- B. Fasten conductors to roof surface on three foot (3 ft.) centers maximum.

#### 3.3 AIR TERMINAL INSTALLATION

- A. Install air terminals at unprotected outside corners of roof perimeter.
- B. Install air terminals along perimeter on twenty foot (20 ft.) centers maximum and place air terminals within two feet (2 ft.) of roof edge.

- C. Connect conductors to air terminals to form a two directional path from each terminal, horizontally or horizontally and downward. Do not install conductors to create a "U" or "V" configuration.

### 3.4 DOWN CONDUCTOR INSTALLATION

- A. Where down conductors are concealed and imbedded in concrete, bond conductor to reinforcing steel top and bottom with a main cable size conductor.
- B. Terminate down conductors in a grounding arrangement suitable to local soil conditions.
- C. Connect down conductors to ground rods at a point one foot (1 ft.) below finished grade and two feet (2 ft.) minimum outside the footing line. Use clamps listed for this purpose.
- D. Mark location of ground rods with a permanent marker.

### 3.5 SYSTEM BONDS

- A. Interconnect electrical service ground with one down conductor ground rod. This connection may be made at the main water service bond point or may be made by connecting one lightning system ground rod with the grounding electrode ground rod.
- B. Bond the domestic water, fire water and natural gas service entrance pipes to the nearest lightning system ground rod or ground loop, where each is a metal pipe.
- C. Bond the storm and sanitary sewer outfall pipes in a similar fashion, provided they are metal piping extending more than five feet (5 ft.) beyond the footing line.
- D. Provide counterpoise loop to interconnect all ground rods with a buried loop conductor around the perimeter. Conductor shall be class II main cable.

End of Section

## SECTION 264313 – SURGE PROTECTION DEVICES

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 DESCRIPTION

- A. General: The term surge protective device (SPD) describes the equipment necessary for the protection of all AC electrical circuits and equipment from the affects of lightning induced voltages, external switching transients and internally generated switching transients.

#### 1.3 REFERENCE STANDARDS AND PUBLICATIONS

- A. General: The latest edition of the following standards and publications shall comply to the work of this section;
  - 1. ANSI/IEEE C62.41 (IEEE 587) Guide for Surge Voltages in Low-Voltage AC Power Circuits Categories A, B and C.
  - 2. ANSI/IEEE C62.33 Standard for Test Specifications for Varistor Surge Protection Devices.
  - 3. ANSI/IEEE C62.45 Guide on Surge Testing for Equipment Connected Low Voltage AC Power Circuits.
  - 4. IEEE Standard 142 - Recommended Practice for Grounding
  - 5. IEEE Standard 518 Recommended Guide on Electrical Noise
  - 7. IEEE Std. 1100 (2005) "The Emerald Book" Section 8.4.2.5
  - 6. UL-1449 3<sup>rd</sup> edition Standard for Surge Protective Devices
  - 7. NFPA 70, 75 and 78 (780).
  - 8. MIL Std. 220A
  - 9. FIPS PUB 94
  - 11. NEC 2008 – National Electrical Code Article 285

#### 1.4 SYSTEM PERFORMANCE CRITERIA

- A. General: Surge suppression, grounding and bonding required by this specification for protection of electrical systems shall effectively protect the systems to which it is applied against lightning, equipment transients, internal spikes, and other surge transients throughout the useful life of the system. Surge protective devices and related grounding and bonding systems shall be designed and installed in such a manner that normal operation and listing of the system is not impaired due to the installation of such devices.

- B. Intent: The intent of this specification is to allow manufacturers with varying equipment concepts to provide transient voltage surge suppression which will properly protect equipment within the guidelines set forth herein. Specific manufacturers listed shall be used as the basis of design, however, submitted components shall comply to the minimum and maximum values listed and shall be equal to or better than the specific manufacturers type specified herein. The listed data specified herein shall be used for the comparative analysis of all manufacturers.

#### 1.5 MANUFACTURER QUALIFICATIONS

- A. General: Those firms responding to this specification shall provide proof that they have been regularly engaged in the design, manufacturing and testing of SPD for not less than twenty five (25) years.
- B. Repair: The surge suppressor manufacturer shall offer factory repair service and replacement for all units. The manufacturer shall provide this service within four working days, and provide replacement components shipped to the Owner for installation within the allocated response time.
- C. Acceptable Manufacturers: Only the following acceptable manufacturers shall be considered; LEA International and Current Technology.

#### 1.6 WARRANTY

- A. Period: All surge suppression devices and supporting components shall be guaranteed for a period of not less than ten (10) years from date of installation. The Contractor shall submit a check-out memo to the manufacturer indicating the date when the equipment was put into service and the actual method of installation. Submit three copies to the Engineer for review.
- B. Replacement: Warranty shall cover unlimited replacement of SPD modules during the warranty period. The warranty shall cover the entire device not just the modules.

#### 1.7 SUBMITTAL

- A. General: Surge protective devices shall be submitted as an integral part of the equipment submittal for the system or equipment which they protect. Surge suppressors and their wiring, bonding, and grounding connections shall be indicated on the wiring diagrams for each system.
- B. Testing: The test data submitted shall be specific for the actual method on installation proposed. Submittals will not be reviewed unless they include proper project related data. Interpretation of standard manufacturers published data will not be acceptable unless the data coincides with the actual installation procedure.



- C. Independent Testing:
1. High exposure with the 10 x 1,000 $\mu$ s tests per IEEE C62.41.2 Section 7.2
  2. Life Cycle/Repetitive Testing per C62.45-2002 section B.38 minimum of 1,000 to 2,000 times.
  3. Additional testing may be required for per phase or per mode fused products with a 200kA or 100kA per phase per IEEE C62. Products must be on line and function after surge test.
- D. Information: The surge suppression submittal shall also include, but shall not be limited to, the following additional data;
1. Complete data for each suppressor type indicating conductor sizes, conductor types, connection configuration, lead lengths and all appropriate dimensions.
  2. Dimensions for each suppressor type indicating mounting dimensions and required accessory hardware.
  3. Manufacturers certified test data indicating the ability of the product to meet or exceed requirements of this specification.
  4. If requested, a sample of each suppressor type to be used for testing and evaluation shall be submitted.
  5. Drawings shall be provided indicating surge protection device mounting arrangement and lead length configuration.
  6. List and detail all protection systems such as fuses.
- E. UL 1449 stipulation for fused SPD – The manufacturer's authorized representative is required to submit the following:
1. Certify that the SPD system is UL 1449 listed (UL Card) with UL Card.
  2. Indicate the type of internal or external fusing that is incorporated in the SPD system and what impact the fusing has on the performance of the device with respect to surge capacity and clamping levels.
- Include Electromagnetic interference filter which provides noise attenuation.
- F. UL 1449 3<sup>rd</sup> edition Voltage protection rating (VPR) is assigned to each mode of protection using a combination wave generator at a setting of 6kV, 3kA. SPD shall have a Nominal discharge current rating (In) of 10kA or 20kA.

#### 1.08 PROJECT CONDITIONS

- A. Each protective device shall have a capacitive filtering system connected in each Line to Neutral (L-N)(Wye) mode or Line to Line (L-L)(Delta) mode to provide EMI/RFI noise attenuation.
- B. Protection modes: The SPD shall provide Line to Neutral (L-N)(Wye or Split phase), Line to Ground (L-G)(All configurations), Line to Line (L-L)(Delta) and Neutral to Ground (N-G)(Wye or Split phase) protection.
- C. Service conditions: Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated

1. Maximum Continuous Operation Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet (6000 m) above sea level.

## PART 2 - PRODUCTS

### 2.1 SERVICE ENTRANCE SUPPRESSORS

- A. Suppressor's minimum surge current capacity shall be of 400kA per phase (L-N plus L-G) and 200kA per mode (L-N, L-G, L-L and N-G) for service entrance panels rated equal to or greater than 2,000 amps.
- B. Suppressor's minimum surge current capacity shall be of 300kA per phase (L-N plus L-G) and 150kA per mode (L-N, L-G, L-L and N-G) for service entrance panels rated less than 2000 amps.
- C. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.
- D. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug-in module or components shall be used in surge carrying paths.
- E. Each protection module shall have a visual indicator that signifies that the protection circuitry is on line. The unit shall not be taken off line to verify integrity of system. The system shall be of modular design with field replaceable modules.
- F. The suppressor shall provide the following monitoring features: dry contacts, digital surge counter and audible alarm with alarm disable switch. Suppressor shall utilize a NEMA 4 or NEMA 12 enclosure.
- H. Types: Surge suppression equipment shall be based on LEA International. Service entrance panels equal to or greater than 2,000 amps shall utilize PV400 Series, and service entrance panels under 2,000 amps shall utilize LSP300 Series.

### 2.2 PANELBOARD SUPPRESSORS

- A. Suppressor's minimum surge current capacity shall be of 200kA per phase (L-N plus L-G) and 100kA per mode (L-N, L-G, L-L and N-G) for panels (feeding any outdoor equipment) rated equal to or greater than 600 amps.
- B. Suppressor's minimum surge current capacity shall be of 100kA per phase (L-N plus L-G) and 50kA per mode (L-N, L-G, L-L and N-G) for branch panels feeding sensitive loads.

- C. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.
- D. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug-in module or components shall be used in surge carrying paths.
- E. The suppressor shall provide the following monitoring features: visual indicator monitoring, dry contacts and audible alarm with alarm disable switch. Suppressor shall utilize a NEMA 4X enclosure.
- F. Types: Surge suppression equipment shall be based on LEA International. Distribution panels equal to or greater than 600 amps shall utilize SP200 Series, and panels less than 600 amps feeding sensitive loads shall utilize SP100 Series.

### PART 3 - EXECUTION

#### 3.1 SEGREGATION OF WIRING

- A. General: All system wiring shall be classified into protected and non-protected categories. Wiring on the exposed side of suppression devices shall be considered unprotected. Surge suppressor grounding and bonding conductors shall also fall into this category.
- B. Protection: All wiring between surge suppressors and protected equipment shall be considered protected and connected in accordance with the latest edition of the NEC.
- C. Separation: A minimum of three inches of separation shall be provided between parallel runs of protected and unprotected wiring in control panels, terminal cabinets, terminal boards and other locations. In no case shall protected and unprotected wiring be bundled together or routed through the same conduit. Where bundles of protected and unprotected wiring cross, such crossings shall be made at right angles.

#### 3.2 INSTALLATION OF SUPPRESSORS

- A. General: Suppressors shall be installed as close as practical to the equipment to be protected consistent with the available space, however, do not exceed five feet for service entrance suppressors and utilize a 3 pole 60 amp breaker for connection means for the service entrance panels. For distribution/panelboards do not exceed eighteen inches and utilize 3 pole 30 amp breaker for connection. Suppressors shall be externally mounted to the panelboards as stand-alone units.
- B. Installation: Suppressor shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space. Suppressors shall be close nipped to the device being protected in a position near the neutral bus which will minimize lead length between suppressors and the buses and disconnect

means to which the suppressor connects. Suppressor leads shall not extend beyond the suppressor manufacturer's recommended maximum lead length without specific approval of the Engineer.

- C. Workmanship: Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be consistent with recommended industry practices for the system on which these devices are installed.

END OF SECTION 26 43 13

## SECTION 265100 – LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified of this section.

#### 1.2 DESCRIPTION

- A. Description of System: Light fixtures provided under this Division shall be provided complete with lamps and all necessary trim and mounting hardware, and installed as shown on the drawings. Light fixtures shall be neatly and firmly mounted, using standard supports for outlets and fixtures. Lamps shall be included in the system guarantee for a period of 90 days after final acceptance of the building. All fixtures and associated products shall be UL listed for the application intended.

#### 1.3 SUBMITTALS

- A. Shop Drawings: Shop drawings shall be submitted for all fixtures ballasts, lamps, special accessories, etc. Submittals for fixtures that require modifications either as specified or as required to fit this projects' architectural field conditions (i.e. luminous ceiling, wall/slot fixtures, special fixtures) shall also be provided.
  - 1. Shop drawings shall be complete showing all dimensions and installation instructions required for this project's architectural/field conditions.
  - 2. Shop drawings for exterior post/pole mounted light fixtures shall be provided and shall clearly indicate handhole and lightning protection ground lug mounted to post/pole at handhole inside post/pole. Submit information on pole mounting, concrete base, etc.
- B. Product Data: Product data shall be submitted for all light fixtures showing:
  - 1. dimensions
  - 2. U.L. Label
  - 3. fusing
  - 4. metal gauge
  - 5. lens/louver thickness
  - 6. finish
  - 7. voltage
  - 8. ballasts
  - 9. lamps
- C. Product data shall be submitted showing manufacturer's written recommendations for storage and protection, and installation instructions.

#### 1.4 PRODUCT STORAGE AND HANDLING

- A. Protection: Physically protect fixtures against damage as recommended by manufacturer.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Fusing: All fluorescent fixtures provided under this Division which do not have electronic ballasts shall be individually fused with a renewable fuse in an external GLR holder. All fluorescent ballasts shall be CBM-ETL accepted, and shall be of the automatic thermal resetting type Class P. Provide ten extra renewable fuses to the Owner.
- B. Testing: All fixtures shall adhere to UL Test Standard No. 1571 and Section 410-65(c) of the National Electrical Code.
- C. Mounting: The contractor shall provide fixture trims and supports as required to match type of ceiling system. No ceiling fixture shall be ordered until the Ceiling System Installer has given written acceptance of the method and location of fixture hanging and fixture type. Fixtures shall be supported independent of the suspended ceiling system. Provide closed link jack chain at all four corners of fixtures utilizing a trapeze inverted "Y" connection. Provide individual supports at all four corners when trapeze connections conflict with mechanical work.
- D. Labels: All light fixtures and ballasts shall be UL listed. All light fixtures shall not have any labels exposed to normal viewing angles. This includes manufacturer labels and U.L. labels. All labels shall be concealed within the body of the fixture. No manufacturers name or logo shall appear on the exterior of any light fixtures unless accepted in writing by the engineer.
- E. Exterior Fixtures: All lighting fixtures mounted outdoors subject to dampness and insects shall have gasketing material between lens door and frame to completely seal interior of fixture. Knockouts and holes in fixtures housing shall be closed and sealed. All fixtures shall be complete with lamps, shielding, brackets, concrete bases, anchor bolts and all necessary fittings and accessories for a complete installation.

#### 2.2 ELECTRONIC BALLAST

- A. General: Ballast shall be electronic type, high power factor and shall be covered by a three-year warranty against defects. Warranty shall include payment for normal labor costs of replacements of inoperative in-warranty ballasts. Ballast shall be rated for voltage system to which applied. The electronic ballast shall incorporate the following min. features:
  - 1. Solid state ballast shall be compatible for use with F-32(32W), F-25(25W) and F-17(17W) straight biax-type lamps.

2. Ballast shall be high frequency (20-62.5 KHz) and operate without detectable flicker.
3. Ballast shall be constant current rated 95 percent power factor.
4. Ballast shall have a thermo-setting, non-toxic, fire retardant partial filler to serve as a conformal coating and protective insulator against both internal and external damage.
5. Ballast shall have internal regulation of power consumption and light output under input line voltage fluctuations.
6. Ballast shall be minimum "A" sound rated and operate quiet.
7. Ballast case temperature shall not exceed 90 degrees C.
8. Ballast shall contain MOV transient surge protection.
9. Ballast shall not cause RFI interference.
10. Ballast shall have total harmonic distortion of less than 20 percent.
11. Ballasts (including compact fluorescent ballasts) shall be Instant Start Type

B. Manufacturers: All ballasts shall be compatible to lamps provided. Ballasts shall be provided by one of the following manufacturers. No substitutions are allowed:

1. MagneTek
2. Advance
3. Valmont
4. Motorola

## 2.3 HID BALLASTS

- A. General: High intensity discharge ballasts shall be constant wattage auto transformer, high power factor type with renewable type KTK fuses in HEB holders. Voltages shall comply with system to which applied. Provide ten extra renewable fuses to the Owner.
- B. Acceptable Manufacturers: Valmont, Advance, MagneTek.
- C. Indoor HID Ballasts: Ballasts shall be encapsulated in standard fluorescent type ballasts cases for quiet operation. Ballasts shall be high power factor. Sound rating shall be minimum "B".
- D. Ballasts: All ballasts shall be compatible with lamps provided. Ballast shall be manufactured by one of the following:
  1. Valmont
  2. Advance
  3. MagneTek

## 2.4 T-8 FLUORESCENT LAMPS

- A. General: Provide lamps as follows:

1. 2 foot lamps, T-8, 17 watts, 3500 degrees K, 80 minimum CRI, 1350 minimum initial lumens, 20,000 average life.
2. 3 foot lamps, T-8, 25 watts, 3500 degrees K, 80 minimum CRI, 2150 minimum initial lumens, 20,000 average life.
3. 4 foot lamps, T-8, 32 watts, 3500 degrees K, 80 minimum CRI, 2850 minimum initial lumens, 20,000 average life.
4. Design Selection: OSRAM-Sylvania, GE, or Philips.

## 2.7 2 FOOT BIAX LAMPS

- A. General: Lamps shall be 40 watts, 3500 degrees K, CRI of 82 minimum, 3150 lumens, 20,000 average rated hours.
- B. Design Selection: GE, OSRAM or Philips.

## 2.8 COMPACT FLUORESCENT

- A. Lamps shall be 3500 degrees K, CRI of 82 minimum. Lamps 13 watts and below shall be rated minimum 10,000 hours life. Lamps 18 watts and above shall be rated minimum 20,000 hours life. Refer to light fixtures schedule for wattage of lamps.
- B. Design Selection: OSRAM-Sylvania, GE, Philips

## PART 3 - PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Sealing: Ducseal shall be installed to seal all conduits entering exterior light fixtures from underground.
- B. Instructions: Install all fixtures in accordance with manufacturer's written instructions and NEC.
- C. Suspended Installation: Pendant mounted fluorescent fixtures installed in exposed ceiling areas are to be suspended from structure with all-thread rods and 1-1/2 x 1-1/2 inch Kindorf channels, full length of fixture/row. Mount outlet box at structure with flexible connection to fixture.
- D. Coordination: Coordinate fixtures installed in mechanical rooms with piping and ductwork prior to installation and relocate fixtures as required to provide proper illumination and access.
- E. All ballasts shall be securely mounted to eliminate resonate humming.

### 3.2 LAMPS



- A. Lamps: Provide two extra lamps for every HID lamp type. Provide ten extra lamps for every incandescent lamp type. Provide ten extra lamps for every fluorescent lamp type.
- B. Lamps shall be "burned in" for a period of 30 days prior to substantial completion of the project. All lamps requiring replacement (flickering, burn out, etc.) during this period through 90 days after Owner Acceptance shall be done so at no additional cost.

### 3.3 CLEAN-UP

- A. Luminaires: Prior to the Owner move-in, the Contractor shall clean all fixtures and remove any dust or dirt. Wash lens and glassware using cleaner such as "Windex" and dry with absorbent cloth. Clean plastic per manufacturer's recommendations; do not wipe. Clean "Alzak" aluminum surfaces (reflectors, fixture cones and the like) per manufacturer's recommendations being careful to remove fingerprints and smudges.

END OF SECTION 26 51 00

## SECTION 263213.13 - EMERGENCY GENERATOR

### Part 1 - General

#### 1.1 Related Documents

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

#### 1.2 Summary

- A. This Section includes packaged engine-generator sets for Standby power supply with the following features:

1. Diesel engine
2. Unit Mounted Cooling System
3. DGC 2020 - Level 1 Expanded
4. Level 0 - OPU
5. Performance Requirements for Sensitive Loads
6. Load Bank(s)

- B. Related Sections include the following:

1. Section 017900 "Demonstration and Training" for specifications covering demonstrations and training of the equipment.
2. Section 260553 "Electrical Identification" for specifications covering electrical systems.
3. Section 231113 "Facility Fuel-Oil Piping" for specifications covering diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems.
4. Section 260526 "Grounding" for specifications covering grounding of components.
5. Section 230553 "Identification for HVAC Piping and Equipment" for specifications covering HVAC piping.
6. Section 017823 "Operation and Maintenance Data" for maintenance and operational specifications.
7. Section 262413 "Distribution Switchboards" for switchboard specifications.
10. Section 263623 "Automatic Transfer Switch" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
11. Section 260519 "Wires and Cables" for specifications covering wiring.

#### 1.3 Definitions

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over a range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
  - B. Standby Rating: Power output rating equal to the power the generator set delivers continuously under normally varying load factors for the duration of the power outage.
- 1.4 Action Submittals
- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
    - 1. Thermal Damage curve for generator.
    - 2. Time-current characteristic of curves for generator protective device.
  - B. Shop Drawings: Detailed equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    - 1. Dimensioned outline plan and elevation drawing of engine-generator set and other components specified.
    - 2. Design Calculations: Signed and sealed by a qualified engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
    - 3. Vibration Isolation Base Details: Signed and sealed by a qualified engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
    - 4. Wiring Diagrams: Power, signal, and control wiring.
- 1.5 Informational Submittals
- A. Manufacturer Seismic Qualification Certification: Submit certification that complete engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
    - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of the assembled components or on calculation.
      - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
      - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Qualification Data:

1. This generator shall be MTU Onsite Energy or equal and who has been regularly engaged in the production of engine-generator sets and associated controls for a minimum of twenty years, thereby identifying one source of supply and responsibility. Equal means having the same system configuration, operation, footprint of the engine-generator set with the same sizing solution. Alternate offerings must be submitted for approval 14 days prior to bid.
2. The manufacturer shall provide factory-trained service and parts support through a factory authorized dealer/supplier that is regularly doing business in the area of installation.
3. The manufacturer shall have printed literature and brochures describing the standard system specified, not a one of a kind fabrication.
4. As part of qualification process; an authorized dealer/supplier, herein known as the dealer shall represent the manufacturer. To qualify as the dealer/supplier, it must be a "Full Product Line Sales and Service Dealer of MTU Onsite Energy" and shall have 24-hour service availability. The dealer/supplier must have certified generator service technicians, inventory of parts to support after sales service and can prove 5 years of experience in the engine-generator field.

C. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.
8. Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures" include the following:
  - a. List of tools and replacement items recommended to be stored at the Project for ready access. Including part and drawing numbers, current prices, and source of supply.

- D. Field quality-control test reports
  - E. Warranty: Special warranty specified in this Section
- 1.6 Closeout Submittals
- A. Operation and Maintenance Data: For packaged engine-generator sets to include emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Closeout Procedures" include the following:
    - 1. List of tools and replacement items recommended to be stored at the Project for ready access. Including part and drawing numbers, current prices, and source of supply.
- 1.7 Maintenance Material Submittals
- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    - 1. Fuses: One for every ten of each type and rating, but no less than one of each.
    - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
    - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
    - 4. Belts: One set of each generator and fan belt.
- 1.8 Quality Assurance
- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
    - 1. Maintenance Proximity: Not more than six hours normal travel time from Installer's place of business to Project site.
    - 2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on the testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
  - B. Manufacturer Qualifications: A qualified manufacturer. Maintain within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
  - C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association (NETA) or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- D. Source Limitations: Obtain packaged engine-generator sets and auxiliary components through one source from a single manufacturer.
- E. Product Options: Drawings indicate size, profiles, and dimensional requirements of packaged generator sets and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
- F. 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.
- G. Comply with ASME B15.1.
- H. Comply with NFPA 37.
- I. Comply with NFPA 30.
- J. Comply with NFPA 70.
- K. Comply with NFPA 99.
- L. Comply with NFPA 110 requirements for Level 1 emergency power supply system.
- M. Comply with UL 2200.
- N. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- O. The packaged engine-generator sets must conform to IBC 2009 with importance factor of  $I_p=1.5$ .
- P. The Open Power Unit engine-generator set(s) must be OSHPD pre-approved through their OSP system. A valid certification must be provided as proof of pre-approval. Calculations for the drop over enclosure shall be submitted with appropriate SE PE Stamp in the State of CA meeting the requirements of the OSHPD CAN 2-1708A-5.
- Q. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.9 Project Conditions

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Construction Manager's written permission.
- B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Minimum Temperature: 0 °F / -17.78 °C
  - 2. Maximum Temperature: 100 °F / 37.78 °C
  - 3. Relative Humidity: 0 - 95 percent
  - 4. Altitude: 1000 feet / 304.8 meters

1.10 Coordination

- A. Coordinate size and location of concrete bases for package engine-generator sets. Cast anchor-bolt inters into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- B. Coordinate size and location of roof curbs, equipment supports, and roof penetrations for remote radiators. These items are specified in Division 07 Section "Roof Accessories."

1.11 Warranty

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine-generator sets and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: 2 Yr - 3000 Hr Basic Standby Limited warranty from date of Substantial Completion.

1.12 Maintenance Service

- A. Initial Maintenance Service: Beginning at Substantial Completion, provide twelve months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as

required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

## Part 2 - Products

### 2.1 Manufacturers

- A. Basis-of-Design Product: Subject to compliance with requirements, provide MTU Onsite Energy Model DS00200D6S-A or a comparable product by one of the following:

1. Kohler.
2. Ring Power.
- .

Any changes to the generator set installation requirements due to manufacturers' products differing from the Basis-of-Design Product are the responsibility of the contractor.

### 2.2 Engine-Generator Set

- A. 200 kW / 250 kVA, 208 Volt 3 Phase 12w 60Hz packaged engine generator set shall be a coordinated assembly of compatible components.
- B. Factory-assembled and -tested, engine-generator set.
- C. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
- D. Capacities and Characteristics:
1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidence by records of prototype testing.
  2. Output Connections: 208 Volt 3 Phase 12w 60Hz
  3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- E. Generator-Set Performance with PMG excitation:
1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
    - a. Nameplate Data for Oversized Generator: Show rating required by the Contract Documents rather than ratings that would normally be applied to the generator size installed.



2. Steady-State Voltage Operational Bandwidth: .25 percent of rated output voltage from no load to full load.
3. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three to four seconds.
4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variation outside the steady-state operational band and no hunting or surging of speed.
6. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply minimum of 300 percent of rated full-load current for not less than 10 seconds without damage to winding insulation or other generator system components.
8. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
  - a. Provide permanent magnet generator for power source to voltage regulator.
9. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 Engine John Deere

- A. Basic Engine: Cast-iron, Oil pan, Dry exhaust manifold and vibration damper.
- B. Rated Engine Speed: 1800 rpm.
- C. Starter: One electric starter 12v DC.
- D. Fuel System: High pressure fuel pump, Electronically controlled injection, Fuel filter and Water separator.
- E. Generator: Engine mounted belt drive.
- F. Lube Oil System: Forced feed lubrication, Lube oil filter, Lube oil heat exchanger, Filler neck and dip stick.
- G. Combustion Air System: Dry type air filter.
- H. Cooling System: Coolant circulation pump and Pusher fan.
- I. Governor: Electronic Control through ECU, with speed sensing.

J. Engine Fuel System:

1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
3. Lift Pump: Provides adequate pressure to the main fuel pump mounted on the engine.
4. Single Canister Fuel Water Separator: Single filter element fuel water separator rated to remove a minimum of 30 microns and smaller while passing full flow.

K. Coolant Jacket Heater: An electric water heater with integral thermostatic control, properly sized to maintain engine jacket water at 90 degrees and suitable for operation in an ambient temperature of -20°F. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

L. Cooling system: Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.

1. High ambient radiator (122 degree).
2. Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
3. Size of radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent of load condition.
4. Expansion Tank: Constructed withstand maximum closed-loop coolant system pressure for engine used.
5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
6. Coolant Hose: Flexible assembly with inside surface of nonporous rubber.
  - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and non-collapsible under vacuum.
  - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

M. Critical Grade Silencer: The silencer shall attenuate exhaust noise to a Critical level.

1. An exhaust silencer and flexible stainless steel exhaust fitting shall be furnished for installation by a mechanical contractor per manufacturer's recommendations. Pipe size shall be sufficiently large to handle the engine exhaust gas flow at full rated load without causing back pressure in excess of that allowed by the engine manufacturer.

- N. Air-Intake Filter: Standard-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- O. Starting System: 12 or 24 volt electric, with negative ground.
  - 1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
  - 2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
  - 3. Cranking Cycle: As required by NFPA 110 for system level specified.
  - 4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
  - 5. Battery Cable: Sized as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
  - 6. Battery Compartment: Battery rack floor mounted constructed of steel, gloss black finish. Include accessories required to support and fasten batteries in place.
  - 7. Battery Charger: 12 or 24VDC, current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
    - a. Operation: Minimum equalizing-charging rate of 10 amps shall be initiated automatically after battery has lost charge until and adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    - b. Automatic Temperature Compensation: Must be equipped with temperature compensation to assure correct charging in all conditions.
    - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus .5 percent.
    - d. Ammeter and Voltmeter: Digital display shall indicate charging rates.
    - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of AC input or DC output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
    - f. Enclosure and Mounting: NEMA-1.

#### 2.4 Fuel Storage

- A. Day Tank: None
- B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:
  - 1. Tank level indicator.
  - 2. Capacity: Fuel for 24 hours continuous operation at 100 percent rated power output.
  - 3. Features:
    - a. Emergency tank and basin vents.
    - b. Mechanical level gauge.
    - c. Fuel supply and return lines, connected to generator set with flexible fuel lines, as recommended by the engine manufacturer, and in compliance with UL2200 and NFPA requirements.
    - d. Leak detection provisions, wired to the generator set control for local and remote alarm indication.
    - e. High and low level float switches to indicate fuel level. Wire switches to generator control for local and remote indication of fuel level.
    - f. Basin drain.
    - g. Integral lifting provisions.
    - h. Vandal-resistant fill cap.
  - 4. Containment Provisions: Comply with requirements of UL142 for double wall tank.

## 2.5 Controls and Monitoring

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, the generator set starts. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts the generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.
- C. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Rigidly mounted to the generator set.

D. Digital Generator Controller

1. Generator Mounted Control Panel: Provide a generator mounted control panel MTU DGC 2020 Level 1
2. Communication: USB, RS485 using Modbus (Slave), and internal industrial grade Modem with dial out and dial in capability, SAE J1939 engine ECU capability and separate RS485 for providing communications to a remote display panel for NFPA 110 indication.
3. Generator Control Panel Protection Features: kWH/kVARH meter, Engine (Over speed, Battery Over/Under Voltage, Auxiliary Excitation and Speed/Frequency Mismatch), Generator (Over/Under Voltage, Over/Under Frequency, Unbalanced Voltage, Dead Bus Detection, Overload, Reverse/Reduced Power)
4. Agency Approvals:
  - a. Conforms to UL 508, Industrial Control Equipment – UL Recognized Component
  - a. Conforms to CSA Std. C22.2 No. 14, Industrial Control Equipment – CSA Certified
  - a. Complies with NFPA 110, Standard for Emergency and Standby Power Systems
5. CE Compliance:
  - a. This product complies with the requirements of the following EC Directives:
  - b. Low Voltage Directive (LVD) - 73/23/EEC as amended by 93/68/EEC
  - c. Electromagnetic Compatibility (EMC) - 89/336/EEC as amended by 92/31/EEC and 93/68/EEC
  - d. EN 50178:1997 - Electronic Equipment for use in Power Installations
  - e. EN 61000-6-4:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Emission Standard for Industrial Environments
  - f. EN 61000-6-2:2001 - Electromagnetic Compatibility (EMC), Generic Standards, Immunity for Industrial Environments
6. Environmental:
  - a. Temperature: Operating: -40 to 70°C (-40 to 158°F), Storage: -40 to 85°C (-40 to 185°F)
  - b. Humidity: IEC 68-2-38
  - c. Salt Fog: ASTM B 17-73, IEC 68-2-11 (tested while operational)
  - d. Ingress Protection: IEC IP54 for front panel

- e. Shock: 15 G in 3 perpendicular planes
- f. Vibration:
  - 5 to 29 to 5 Hz: 1.5 G peak for 5 min.
  - 29 to 52 to 29 Hz: 0.036" DECS-A for 2.5 min.
  - 52 to 500 to 52 Hz: 5 G peak for 7.5 min.

7. Engine Control:

- a. Cranking Control: Cycle or Continuous (Quantity and Duration Fully Programmable)
- b. Engine Cool down
- c. Successful Start Counter: Counts and records successful engine starts
- d. Timers including, but not limited to:
  - Engine Cool down Timer
  - Engine Maintenance Timer
  - Pre-Alarm Time Delays for Weak/Low Battery Voltage
  - Alarm Time Delay for Over speed
  - Alarm Time Delay for Sender Failure.
  - Arming Time Delays after Crank Disconnect:
    - Low Oil Pressure
    - High Coolant Temperature

8. Alarms:

- a. Low Oil Pressure
- b. High Coolant Temperature
- c. Low Coolant Level
- d. Low Fuel Level
- e. Over speed
- f. Over crank
- g. Engine Sender Unit Failure
- h. Fuel Leak/Fuel Sender Failure
- i. Emergency Stop
- j. Battery Charger Failure
- k. Critical Low Fuel Shutdown

9. Pre-Alarms:

- a. Low Oil Pressure
- b. High Coolant Temperature
- c. Low Coolant Temperature
- d. Battery Overvoltage
- e. Weak Battery
- f. Battery Charger Failure
- g. Engine Sender Unit Failure
- h. Engine kW Overload (3 levels)
- i. Maintenance Interval Timer
- j. Low Coolant Level

- k. Low Fuel Level
- l. Fuel Leak Detect
- m. High Fuel Level

10. Generator Protection ANSI Functions:

- a. Under voltage (27)
- b. Overvoltage (59)
- c. ANSI Codes Reverse Power (32)
- d. Over frequency (81O)
- e. Loss of Excitation (40Q)
- f. Under frequency (81U)

E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following accessories:

- 4-Relay: The 4-relay board includes (4) 10 amp form C relays customizable for user defined functionality requirements. Standard outputs as follows:
  - Engine Run
  - Engine Fail
  - Minor Alarm
  - Spare
- Critical Low Fuel Alarm: Shutdown engine when fuel supply is below 10%.
- High Fuel Pre-Alarm: A pre-alarm will be active if fuel level is above 95%.

F. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

G. Connection to Data Link: A separate terminal block, factor wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals. Data system connections to terminals are covered in Section 260913 "electrical Power Monitoring and Control."

H. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

- 1. Overcrank Shutdown.
- 2. Coolant Low-temperature Alarm.
- 3. Control Switch Not in Auto Position.
- 4. Battery-charger Malfunction Alarm.
- 5. Battery Low-voltage Alarm.

- I. Common Remote Audible Alarm: Signal the occurrence of any event listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
1. Engine High-temperature Shutdown.
  2. Lube-oil, Low-pressure Shutdown.
  3. Overspeed Shutdown.
  4. Remote Emergency-stop Shutdown.
  5. Engine High-temperature Pre-alarm.
  6. Lube-oil, Low-pressure Pre-alarm.
  7. Fuel Tank, Low-fuel Level.
  8. Low Coolant Level.
- J. Remote Alarm Annunciator: Designed for compliance with NFPA 110. LEDs labeled with proper alarm conditions identify each alarm as well as an audible signal for each alarm condition. Silencing switch in face of panel silences signal without altering visual indication. Cabinet and faceplate are surface- or flush-mounting type to suit mounting conditions indicated.

LED indications are provided for the following:

1. Alarms:
  - a. Low Coolant Level
  - b. High Coolant Temperature
  - c. Low Oil Pressure
  - d. Overcrank
  - e. Overspeed
  - f. Emergency Stop Activated
  - g. Fuel Leak
  - h. Sender Failure
2. Pre-alarms:
  - a. High Coolant Temperature
  - b. Low Coolant Temperature
  - c. Low Oil Pressure
  - d. Low Fuel Level
  - e. Battery Overvoltage
  - f. Weak Battery
  - g. Battery charger Failure
3. Operational status:
  - a. Switch Not in Auto
  - b. Display Panel On
  - c. EPS Supplying Load



- K. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button is protected from accidental operation.
  - L. Differential Current Transformer: None
  - M. Paralleling Current Transformer: None
  - N. Voltage Regulator Sensing Potential Transformer: None
- 2.6 Generator Overcurrent and Fault Protection
- A. Generator Circuit Breaker: Adjustable thermal-magnetic trip type; 80 percent rated; complying with NEMA AB 1 and UL 489.
    - 1. Manufacturers:
      - a. General Electric
      - b. Cutler Hammer
      - c. Square D
  - B. Product Description: Enclosed, molded-case circuit breaker conforming to NEMA AB 1 and FS-W-C.
  - C. Accessories: Conform to NEMA AB 1.
    - 1. Shunt Trip Device: 24 volts, DC.
    - 2. Undervoltage Trip Device.
    - 3. Auxiliary Switch: 120 volts, AC.
    - 4. Alarm Switch: 120 volts, AC.
    - 5. Handle Lock: Provisions for padlocking.
    - 6. Enclosure: NEMA ICS 6, Type [ 1 , 4 , 3R Stainless Steel or better ], mounted on the engine-generator set.

D. Series Rating: Series rated breakers shall not be used.

4. Bell Alarm: None
5. Shunt Trip: Provides remote control capability to open circuit breaker.

B. Generator Protection: Microprocessor-based device shall continuously monitor the total kVA level of the generator output, annunciating conditions that may result in generator damage.

Protective devices shall perform the following functions:

1. Initiates a generator overload pre-alarm when generator has operated at an overload equivalent to 105 percent of full-rated load for 5 seconds. Indication for this alarm is integrated with other generator set malfunction pre-alarms.
2. Indicates a generator overload alarm when generator has operated at an overload equivalent to 105 percent of full-rated load for 300 seconds. Indication for this alarm is integrated with other generator set malfunction alarms.

C. Ground-Fault Indication: None

## 2.7 Generator, Exciter, and Voltage Regulator

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to the engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Drip proof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: PM300 voltage regulator is an encapsulated electronic voltage regulator that controls the output of a brushless AC generator by regulating the current into the exciter field.

<b>SPECIFICATION</b>	<b>PM300 REGULATOR</b>
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Sensing	190-240 Vac 50 / 60 Hz
Power Input	190-240 Vac 250 / 300 Hz
Burden	500 VA
Output Power- Continuous	63 Vdc at 3.5 Adc (190w)
Output Power - Forcing(240 Vac Input	105 Vdc at 5 Adc (525w)
Regulation	1 .0%
Remote Voltage Adjustment Range	± 10% with 2000 ohm rheostat ± 5% with 1000 ohm rheostat
Frequency Compensation	Adjustable
Roll off frequency	54-61 Hz for 60 Hz 45-51 Hz for 50 Hz
Operation	Weight6.5 oz.
Operating Temperature	- 40°C to + 60°C
Storage Temperature	- 65°C to + 85°C
Power Dissipation	8 watts maximum
Size	3.94" L X 2.66" W X 2.20: H
EMI Suppression	Internal Electromagnetic Interference Filter (EMI Filter )

- I. Strip Heater: None
- J. Bearing RTD: None
- K. Stator RTD: None
- 2.8 Outdoor Generator-set Enclosure
  - A. Description: No housing included.
- 2.9 Vibration Isolation Devices
  - A. Neoprene Pad
    - 1. ¼ inch thick elastomeric pad in square shape to be placed under the base frame at each of the pre-drilled isolator mounting holes.
    - 2. Helps to prevent sliding of the unit as well as reducing the transmission of sound and vibration into the floor.
- 2.10 Finishes
  - A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.
- 2.11 Source Quality Control

- A. Prototype Testing: factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
  - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
  - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
  - 2. Full Load Run.
  - 3. Maximum Power.
  - 4. Voltage Regulation.
  - 5. Transient and Steady-State Governing.
  - 6. Single-Step Load Pickup.
  - 7. Safety Shutdown.
  - 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
  - 9. Report factory test results within 10 days of completion of test.

### Part 3 - Execution

#### 3.1 Examination

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator set performance.
- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 Installation

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

- C. Install packaged engine-generator with VMC Group OSHPD pre-approved vibration spring isolators having a minimum deflection of 1.07 inches on a 10 inch high concrete base. Secure sets to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

### 3.3 Connections

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.
- B. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.
- C. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- D. Connect fuel piping to engines with a gate valve and union and flexible connector.
  - 1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in Division 23 Section "Facility Fuel-Oil Piping."
  - 2. Natural-gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural-Gas Piping."
  - 3. LP-gas piping, valves, and specialties for gas piping are specified in Division 23 Section "Facility Liquefied-Petroleum Gas Piping."
- E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.4 Identification

- A. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

### 3.5 Field Quality Control

- A. Testing Agency: **[Owner will engage or Engage]** a qualified testing agency to perform tests and inspections and prepare test reports.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
  - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical for "AC Generators and for Emergency Systems" specified by NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
  - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
    - c. Verify acceptance of charge for each element of the battery after discharge.
    - d. Verify that measurements are within manufacturer's specifications.
  - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  - 6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
  - 7. Exhaust Emissions Test: Comply with applicable government test criteria.
  - 8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
  - 9. Noise Level Tests: Provide calculated noise measurement of the complete generator package.

- E. Coordinate tests for transfer switches and run them concurrently.
  - F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
  - G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - J. Remove and replace malfunctioning units and retest as specified above.
  - K. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
  - L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
  - M. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each buss connection. Remove all access panels so terminations and connections are accessible to a portable scanner.
    - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
    - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Included notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 3.6 Demonstration
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 26 3213.13





## SECTION 263623 – AUTOMATIC TRANSFER SWITCH

### PART 1 - GENERAL

- 1.1 The transfer switch shall be rated for the voltage and ampacity as shown on the plans and shall have 600 volt insulation on all parts in accordance with NEMA standards.
- 1.2 The current rating shall be a continuous rating when the switch is installed in an unventilated enclosure, and shall conform to NEMA temperature rise standards.
- 1.3 The unit shall be rated based on all classes of loads, i.e., resistive, tungsten, ballast and inductive loads. Switches rated 400 amperes or less shall be UL listed for 100% tungsten lamp load.
- 1.4 As a precondition for approval, all transfer switches complete with accessories shall be listed by Underwriters Laboratories, under Standard UL 1008 (automatic transfer switches) and approved for use on emergency systems.
- 1.5 The withstand current capacity of the main contacts shall not be less than 20 times the continuous duty rating when coordinated with any molded case circuit breaker established by certified test data. Refer to required withstand and close ratings as detailed in this specification.
- 1.6 Temperature rise tests in accordance with UL 1008 shall have been conducted after the overload and endurance tests to confirm the ability of the units to carry their rated currents within the allowable temperature limits.
- 1.7 Transfer switches shall comply with the applicable standards of UL, CSA, ANSI, NFPA, IEEE, NEMA and IEC.
- 1.8 The transfer switches shall be supplied with a microprocessor based control panel as detailed further in these specifications.

### PART 2 -SEQUENCE OF OPERATION

- 2.1 The ATS shall incorporate adjustable three phase (or single phase as applicable) under voltage sensing on the normal source.
- 2.2 When the voltage of any phase of the normal source is reduced to 80% of nominal voltage, for a period of 0-10 seconds (programmable) a pilot contact shall close to initiate starting of the engine generator.
- 2.3 The ATS shall incorporate adjustable under voltage and under frequency sensing on the emergency source.

- 2.4 When the emergency source has reached a voltage value of 90% of nominal and achieved frequency within 95% of the rated value, the load shall be transferred to the emergency source after a programmable time delay.
- 2.5 When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be retransferred to the normal source after a time delay of 0 to 30 minutes (programmable). The generator shall run unloaded for 5 minutes (programmable) and then automatically shut down. The generator shall be ready for automatic operation upon the next failure of the normal source.
- 2.6 If the engine generator should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of proper voltage (90%) on the normal source.
- 2.7 Inspection and operational tests shall be conducted by the contractor in the presence of the engineer, to indicate that the switch satisfies the specifications.
- 2.8 The transfer switch shall be equipped with a microprocessor based control panel. The control panel shall perform the operational and display functions of the transfer switch. The display functions of the control panel shall include ATS position, source availability, sequence indication and diagnostics.
- 2.9 The display shall be accessible without opening the enclosure door.
- 2.10 The control panel shall be provided with a simple user interface for transfer switch monitoring, control and field changeable functions and settings.
- 2.11 The control panel shall be opto-isolated from electrical noise and provided with the following inherent control functions and capabilities:
  - a. Built-in diagnostic display.
  - b. Capability for external communication and network interface.
  - c. Touch pad test switch with Fast Test/Load/No Load selection capability to simulate a normal source failure.
  - d. Time delay to override momentary normal source failure prior to engine start. Field programmable 0-10 seconds factory set at 3 seconds.
  - e. Time delay on retransfer to normal source, programmable 0-30 minutes factory set at 30 minutes. If the emergency source fails during the retransfer time delay, the transfer switch controls shall automatically bypass the time delay and immediately retransfer to the normal position.
  - f. Time delay on transfer to emergency, programmable 0-15 seconds, factory set at 1 second.
  - g. An in-phase monitor shall be provided. The monitor shall compare the phase angle difference between the normal and emergency sources and

be programmed to anticipate the zero crossing point to minimize switching transients.

- h. An exerciser timer shall be incorporated within the microprocessor and shall be capable of starting the engine generator set and transferring the load (when selected) for exercise purposes on a weekly basis. The exerciser shall contain a battery for memory retention during an outage.
- i. Provide a momentary pushbutton to bypass the time delays on transfer and retransfer and programmable commit/no commit control logic.

2.12 Note to Specifier: Please see attached list of additional accessories available (found under SPECIFIER NOTES #3) and insert in this section as required.

### PART 3 - CONSTRUCTION AND PERFORMANCE

- 3.1 The automatic transfer switch shall be of double throw construction operated by a reliable electrical mechanism momentarily energized. There shall be a direct mechanical coupling to facilitate transfer in 6 cycles or less.
- 3.2 The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.
- 3.3 For switches installed in systems having ground fault protective devices, and/or wired so as to be designated a separately derived system by the NEC, a 4th pole shall be provided. This additional pole shall isolate the normal and emergency neutrals. The neutral pole shall have the same withstand and operational ratings as the other poles and shall be arranged to break last and make first to minimize neutral switching transients. Add-on or accessory poles that are not of identical construction and withstand capability are not acceptable.
- 3.4 The contact structure shall consist of a main current carrying contact which is a silver alloy with a minimum of 50% silver content. The current carrying contacts shall be protected by silver tungsten arcing contacts on all sizes above 400 Amps.
- 3.5 The transfer switch manufacturer shall submit test data for each size switch, showing it can withstand fault currents of the magnitude and the duration necessary to maintain the system integrity. Minimum UL listed withstand and close into fault ratings shall be as follows:

<u>Size (Amps)</u>	<u>Coordinated Molded Case Breaker</u>
Up to 225	30,000
226 - 400	50,000
401 - 800	65,000
801 - 1200	85,000
1201 - 4000	100,000
<u>Size (Amps)</u>	<u>Current Limiting Fuse</u>

Up to 4000

200,000

\*All values 480 volt, RMS symmetrical, less than 20% power factor.

- 3.6 A dielectric test at the conclusion of the withstand and closing tests shall be performed.
- 3.7 The automatic transfer switch manufacturer shall certify sufficient arc interrupting capabilities for 50 cycles of operation between a normal and emergency source that are 120 degrees out of phase at 480 volts, 600% of rated current at .50 power factor. This certification is to ensure that there will be no current flow between the two isolated sources during switching.
- 3.8 All relays shall be continuous duty industrial type with wiping contacts. Customer interface contacts shall be rated 10 amperes minimum. Coils, relays, timers and accessories shall be readily front accessible. The control panel and power section shall be interconnected with a harness and keyed disconnect plugs for maintenance.
- 3.9 Main and arcing contacts shall be visible without major disassembly to facilitate inspection and maintenance.
- 3.10 A manual handle shall be provided for maintenance purposes with the switch de-energized. An operator disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation.
- 3.11 The switch shall be mounted in a NEMA 1 enclosure unless otherwise indicated on the plans.
- 3.12 Switches composed of molded case breakers, contactors or components thereof not specifically designed as an automatic transfer switch will not be acceptable.
- 3.14** The automatic transfer switch must be equipped with a solenoid protection scheme that removes any attempts of operating the solenoids after (3) consecutive trials until manual intervention by an operator.
- 3.15.1** The automatic transfer switch shall be MTU Onsite Energy MTG Series or approved equal.

#### PART 4 - SPECIFIER NOTES:

1. Standard dropout voltage is 80%, pickup 90% of nominal. Settings are adjustable. Specify pickup/dropout if other than factory standard is desired.
2. MTG switches are in conformance with the applicable portions of:
  - UL 1008: Underwriters Laboratories standard for automatic transfer switches
  - CSA: C22.2 No. 178 certified at 600 VAC

IEC:	947-6-1 certified at 480 VAC
NFPA 70:	National Electrical Code including use in emergency and standby systems in accordance with Articles 517, 700, 701, 702
NFPA 99:	Essential electrical systems for health care facilities
NFPA 101:	Life safety code
NFPA 110:	Standard for emergency and standby power systems
IEEE 241:	I.E.E.E. recommended practice for electrical power systems in commercial buildings
IEEE 446:	I.E.E.E. recommended practice for emergency and standby power systems
NEMA ICS10:	AC automatic transfer switch equipment (supercedes ICS2-447)
UL 50/508:	Enclosures
ICS 6:	Enclosures
ANSI C33.76:	Enclosures
NEMA 250:	Enclosures
IEEE 472:	(ANSI C37.90A): Ringing wave immunity
EN55022	(CISPR11): Conducted and radiated emissions (Exceeds EN55011 & MILSTD 461 Class 3)
EN61000-4-2:	(Level 4): ESD immunity test Class B:
EN61000-4-3:	(ENV50140): Radiated RF, electromagnetic field immunity test
EN61000-4-4:	Electrical fast transient/burst immunity test
EN61000-4-5:	IEEE C62.41: Surge immunity test (1.2 x 50Fs, 5 & 8 kV)
EN61000-4-6:	(ENV50141): Conducted immunity test
EN61000-4-11:	Voltage dips and interruption immunity
3.	Listed below are other frequently requested optional features which are available for MTG transfer switches:
A6	Motor disconnect (1 contact N. C.)

C	Plant Exerciser Clock - No Load (solid state, 7 day)
D	Plant Exerciser Clock - Load (solid state, 7 day)
C/D	Plant Exerciser Clock - Load/No Load (solid state, 7 day)
CD365	Plant Exercise Clock - Load/No Load (solid state, 365 day)
HT	Heater and Thermostat
Q2	Peak Shave/Remote Load Test
Q3	Transfer inhibit to emergency
T3/W3	Transfer presignal (1 contact N. O.)
ZNET100	Communications interface card
6A	Test Switch (maintained)

END OF SECTION 26 3623

## SECTION 275114 – EMERGENCY CALL SYSTEM

### PART 1. - GENERAL DESCRIPTION

- 1.1 The unit shall be an Area of Rescue Sign, model ETP-SIGN, no substitutions. Sign shall be self-adhesive and identify a location as an ADA Area of Rescue Assistance.
- 1.2 CONSTRUCTION
  - 1.2.1 The Sign shall be constructed of blue ultra-violet light-resistant polycarbonate and measure approximately 6" W x 4" H.
  - 1.2.2 The Sign shall state "AREA OF RESCUE" in both English and Braille and display the international symbol of accessibility.
- 1.3 MOUNTING
  - 1.3.1 Sign shall be self-adhesive.
- 1.4 OPTIONS
  - 1.4.1 Sign shall be available with text reading "AREA OF REFUGE" as model ETP-SIGN/R
- 1.5. WARRANTY
  - 1.5.1 Product shall be warrantied against any defects in material and workmanship, under normal use, for a period of two years from date of installation. In the event system is found by manufacturer to be defective within the warranty period, manufacturer shall repair and/or replace any defective parts, provided the equipment is returned to manufacturer.
- 1.6 MANUFACTURER
  - 1.6.1 The Manufacturer shall be Talk-A-Phone Co. (773) 539-1100, 7530 N. Natchez Ave, Niles, Illinois 60714-3804, [www.talkaphone.com](http://www.talkaphone.com). THERE ARE NO EQUIVALENTS.
- 1.7 GENERAL DESCRIPTION
  - 1.7.1 The Emergency Phone shall consist of a vandal resistant hands-free speakerphone communications device with a stainless steel faceplate and metal button.
  - 1.7.2 The Emergency Phone shall be Talk-A-Phone model ETP-100E, no substitutions, and have one anodized aluminum tactile button labeled "FOR HELP PUSH ONCE" and one 0.375" diameter red light emitting diode (LED) labeled "YOU MAY SPEAK WHEN LIGHT ON" and MOMENTARY LIGHT INDICATES ALARM RECEIVED, HELP COMING". The unit itself shall further be labeled "EMERGENCY PHONE".
  - 1.7.3 The unit shall be programmable from a remote location and have a two number dialing capability, reverting to the second number if the first is busy or does not respond. The unit shall be totally hands-free on both sides after connection is initiated at site or by attendant. The unit shall be phone line powered, requiring no outside power source or battery back-up. DIP switch

programming, push to talk devices, and devices requiring external power are not acceptable. The unit shall have a dedicated communication line.

## PART 2 - CONSTRUCTION

- 2.1 Chassis and face plate shall be constructed of stainless steel.
- 2.2 Faceplate shall be 12 gauge #4 brushed stainless steel measuring 9.5" W x 11.75" H.
- 2.3 Back Box shall be constructed of zinc-plated steel and require a wall cut-out of approximately 4.5" W x 7.5" H x 2.5" D.
- 2.4 Unit shall weigh approximately 6 lbs.
- 2.5 Signage shall be silk-screened directly to faceplate.
- 2.6 Push button and switch shall be a single assembly rated for 1,000,000 cycles. Epoxy seals shall protect contacts and terminals from hostile environments and solder flux. Case shall be moisture-proof, dust-tight and designed to accommodate the high shock military specifications of MIL-STD-202, method 207. Case shall be aluminum alloy, anodized clear. Button shall be aluminum painted uv-resistant black.
- 2.7 Speaker and microphone shall be protected by non-ferrous metal screen to provide a barrier against vandalism.

## PART 3 - FEATURES

- 3.1 Unit shall be capable of operating on standard phone lines or analog PBX extensions.
- 3.2. Unit shall dial at approximately 10 tones per second.
- 3.3 All programming shall be stored in non-volatile EEPROM memory.
- 3.4 Button shall provide tactile feedback.
- 3.5 Unit shall be programmable from a remote telephone via keypad entry.
- 3.6 Call timer shall be programmable from 1 to 4320 minutes.
- 3.7 LED for the hearing impaired shall illuminate to indicate when calling party may speak (when receiving party is silent).
- 3.8 Unit shall be programmable with two different telephone numbers of up to 18 digits each including pauses. If first number does not answer or is busy, unit shall automatically call the second number. If that number is busy or does not answer, unit shall call the first number again. Unit shall continue alternating until call is answered or call timer limit is reached.
- 3.9 Unit shall be capable of automatically notifying attendant of location via programmable 6 digit ID.
- 3.10 Unit shall be capable of silent monitoring.
- 3.11 Unit shall utilize tone dialing.



- 3.12 When call is finished, unit shall automatically shut off.
- 3.13 Unit shall answer any call placed to it from any other telephone.
- 3.14 Two levels of programmable passwords shall be available.
- 3.15 Unit shall be varistor lightening suppressed and full wave polarity guarded.
- 3.16 Unit shall have parallel tip and ring connected to an RJ-11 connector for quick installation.
- 3.17 Unit shall be compatible with Talk-A-Lert® diagnostics/base-station package, model ETP-TAL.
- 3.18 Unit shall comply with Part 68 of the FCC rules for the United States.

#### PART 4 - ELECTRICAL

- 4.1 Unit shall be fully phone line powered, requiring no external power or battery back-up.
- 4.2 One dedicated, twisted-shielded communication pair shall provide a minimum of 24VDC and 20mA while off hook.

#### PART 5 - MOUNTING

- 5.1 Unit shall be designed for mounting on an existing front return or side wall or in an elevator car operating panel.
- 5.2 Flush Mounting Sleeve, model MS-400, shall be available to mount Emergency Phone flush into a wall.

#### PART 6 - OPTIONS

- 6.1 Unit shall be available with built-in cast metal raised lettering and Braille to provide greater ADA compliance as model ETP-100EB.
- 6.2. Unit shall be available with built-in auxiliary input and two auxiliary outputs as model ETP-100E-AUX.
  - 6.2.1 Auxiliary outputs and auxiliary input shall be opto-isolated from the telephone line to 1,000 volts.
  - 6.2.2 Outputs shall be activated, providing a dry contact closure, either automatically when Emergency Phone is activated or manually by guard keypad.
  - 6.2.3 Input shall allow unit to be activated by any device or switch that provides a contact closure.
- 6.3 Unit shall be available with Intelli-Voice Location Identifier as model ETP-100EV.
  - 6.3.1 Message shall transmit as soon as call is answered.
  - 6.3.2 Message shall be repeatable upon request of operator.
  - 6.3.3 Message duration shall be programmable as 5, 10 or 16 seconds.

- 6.3.4 Location identifier message and duration shall be programmable from remote location.
- 6.4 Unit shall be available with Scream Alert™, model SA-1.
  - 6.4.1 Scream shall cause actuation of Emergency Phone. This requires -AUX option.
  - 6.4.2 Gain level and duration of sound required to actuate Emergency Phone shall be adjustable.
- 6.5 Unit shall be compatible with a cellular interface to allow the use of any compatible cellular provider to provide wireless phone connection.
  - 6.5.1 Transmission shall be CDMA using model ETP-CI/CDMA.
- 6.6 Unit shall be compatible with a fiber optic interface available from International Fiber Systems (IFS).

#### PART 7 - WARRANTY

- 7.1 Equipment shall be warrantied against any defects in material and workmanship, under normal use, for a period of twenty-four months from date of installation. In the event system is found by manufacturer to be defective within the warranty period, manufacturer shall repair and/or replace any defective parts, provided the equipment is returned to manufacturer.

#### PART 8 - MANUFACTURER

- 8.1 The Manufacturer shall be Talk-A-Phone Co. (773) 539-1100, 7530 N. Natchez Ave, Niles, Illinois 60714-3804, [www.talkaphone.com](http://www.talkaphone.com). THERE ARE NO EQUIVALENTS.

#### PART 9 - GENERAL DESCRIPTION

- 9.1 "Areas of Rescue Assistance" are mandated by the Americans With Disabilities Act (ADA) as a means of providing greater safety to people with disabilities in case of an emergency. An Area of Rescue Assistance system enables two-way communication between a rescue site, such as a stairwell or foyer, and a central command station, such as a main lobby, fire command station, or security office.
- 9.2 The Area of Rescue Assistance (ARA) system shall consist of a microprocessor-based Command Unit, model CU-16, and up to 10 ARA Stations, models ETP-100, manufactured by Talk-A-Phone Co., no substitutions. This system shall meet the Federal Government's guidelines as an Areas of Rescue Assistance system under the ADA.

#### PART 10 - CONSTRUCTION

- 10.1 Command Unit
  - 10.1.1 Unit shall be protected in a 16-gauge #4 brushed stainless steel cabinet including all necessary components except Strobe/Siren, UPS and mounting hardware.
  - 10.1.2 Unit shall be contained within an enclosure approximately 24.25" W x 23.88" H x 4" D. Enclosure shall include three Lexan windows: one revealing handset and operating instructions, the other

two enabling emergency personnel to monitor the ARA Station LEDs.

- 10.1.3 Unit shall have 22 RJ11 modular phone ports for connecting 16 ARA stations, a 2-line local phone, two telco lines in and two telco lines out.
- 10.1.4 Conduit hole knockouts shall be provided on top, bottom and back of enclosure.
- 10.2 ARA Stations
  - 10.2.1 ARA Stations shall be highly vandal-resistant and fully ADA compliant.
  - 10.2.2 Face plates shall be 12 gauge #4 brushed stainless steel.
  - 10.2.3 Speaker and microphone shall be protected by a metal screen.
  - 10.2.4 Units shall incorporate all-metal raised letter and Braille plate which reads "EMERGENCY" in both standard English and Braille. Call button shall be incorporated into the plate for easy identification and use by the visually impaired. All letters shall be raised by 3/32" and comply fully with all requirements of the ADA.

## PART 11 - FEATURES

- 11.1 Vandal resistant ARA Stations shall be hands-free at all times and comply fully with the Americans With Disabilities Act (ADA).
- 11.2 System shall provide for dedicated communications lines from ARA Stations to Command Unit.
- 11.3 During an Emergency Call, system shall provide two way visual and audible communication between Command Unit and ARA Stations.
- 11.4 When a call is placed from an ARA Station, a strobe/siren shall be activated at the Command Unit.
  - 11.4.1 Siren shall offer eight sound options and two volume levels, selected via dipswitches.
  - 11.4.2 Sound output shall range from 90dBA to 100dBA.
  - 11.4.3 Strobe/Siren assembly shall mount into a standard 4 inch square box.
- 11.5 System shall require no phone lines for on-site calling.
- 11.6 Two phone lines—either CO line or PBX extension—shall be required for off-site calling (one for every 8 ARA Stations). These lines may be shared with another device. If the Command Unit requires a line it shall have line seizure capability.
- 11.7 Unit shall be programmable where if the local phone is busy or not answered, an ARA Station's call will be automatically routed to a Telco line and a pre-programmed number dialed. If the call is not answered at this number, a secondary number shall be automatically dialed. The process shall continue until someone answers the call or the ARA Station times out.
- 11.8 Command Unit shall have the ability to originate a call to each ARA Station.
- 11.9 When an ARA Station is activated, a phone shall ring at the Command Unit.

- 11.10 ARA system shall be able to function if multiple rescue calls come in simultaneously. When operator is in conversation with one ARA Station, secondary calls shall be placed in queue and automatically put through when the first call is completed.

## PART 12 - LIGHTING

### 12.1 LEDs

- 12.1.1 Unit shall have one LED for each of 16 ARA Stations. When the Station is ringing the Command Unit, the LED shall blink. When the Station is in communication with the Command Unit, the LED shall light solidly. When the Command Unit is in communication with one Station and secondary Stations are activated, the LEDs for those secondary Stations shall blink.

- 12.1.2 Unit shall have four separate LEDs—four for each set of 8 ARA stations—to indicate: system power, telco line in use, telco line ringing, and local phone off-hook.

### 12.2 Strobe

- 12.2.1 When an ARA station is activated, a strobe shall begin flashing at the Command Unit location. Strobe shall continue to flash as long as any Stations are active.

- 12.2.2 Strobe shall be rated at 15 candela and flash 60 times per minute.

## PART 13 - ELECTRICAL

### 13.1 Command Unit

- 13.1.1 Command Unit shall include operation of system for at least 4 hours in a power failure.

- 13.1.2 ARA Stations, Telco line in and Telco line out shall plug into RJ11 receptacles on Command Unit. All other components shall be plugged into included Power Strip, which in turn is plugged into UPS.

- 13.1.3 Strobe/Siren assembly and its power supply, all relays and power strip shall be UL listed.

### 13.2 ARA Stations

- 13.2.1 All ARA Stations shall receive power from Command Unit and require no other source.

- 13.2.2 ARA Stations shall require only one twisted, shielded pair home-run to Command Unit and terminating in RJ11 plugs.

- 13.2.3 Wiring between ARA Stations and Command Unit shall not exceed resistance of 25 Ohms.

- 13.2.4 ARA Stations shall be varistor lightning suppressed and full wave polarity guarded.

## PART 14 - MOUNTING

### 14.1 Command Unit

- 14.1.1 Conduit hole knock-outs shall be provided in top, bottom and back of enclosure to allow easy connection between Master Station and ARA Stations, Strobe/Siren and UPS.
- 14.1.2 Unit shall be surface mountable.
- 14.2 ARA Stations
  - 14.2.1 ARA Stations shall be surface mounted, model ETP-100MB, or flush mounted, models ETP-100EB and MS-400.
  - 14.2.2 For ADA compliance, top of ARA Station shall be at most 51" above finished floor.
  - 14.2.3 ARA Stations shall be affixed to surface using Tamper-proof screws.

#### PART 15 - OPTIONS

- 15.1 ARA Stations shall include a recorded message location identifier.
  - 15.1.1 Surface mounted stations shall be model ETP-100MBV. Flush mounted stations shall be models ETP-100EBV and MS-400.
  - 15.1.2 Message shall transmit as soon as emergency call is answered.
  - 15.1.3 Message shall be repeatable upon request of operator.
  - 15.1.4 Message duration shall be programmable as 5, 10 or 16 seconds.
  - 15.1.5 Location identifier message and duration shall be programmable from local phone handset or remote location using Telco line in.
- 15.2 ARA Stations shall include an ARA sign designating the area as an Area of Rescue.
  - 15.2.1 Sign shall be self-adhesive, model ETP-SIGN, made of UV light resistant polycarbonate. Sign shall read "AREA OF RESCUE" in both standard English and Braille for ADA compliance.
  - 15.2.2 Sign shall be self-adhesive, model ETP-SIGN-R, made of UV light resistant polycarbonate. Sign shall read "AREA OF REFUGE" in both standard English and Braille for ADA compliance.
  - 15.2.3 Sign shall be wall or ceiling mounted, model ETP-SIGN/L, made of white steel with red lettering. Sign shall be backlit and read "AREA OF RESCUE".
  - 15.2.4 Sign shall be wall or ceiling mounted, model ETP-SIGN/LR, made of white steel with red lettering. Sign shall be backlit and read "AREA OF REFUGE".
  - 15.2.5 Sign shall be wall or ceiling mounted, model ETP-SIGN/LD, with a metal frame and lighted Lexan plate. Lexan plate shall read "AREA OF RESCUE". Sign shall include built-in battery back-up in case of power failure.
  - 15.2.6 Sign shall be wall or ceiling mounted, model ETP-SIGN/LDR, with a metal frame and lighted Lexan plate. Lexan plate shall read "AREA OF REFUGE". Sign shall include built-in battery back-up in case of power failure.

- 15.2.7 Sign shall be self-adhesive, model ETP-SIGN-PFH, made of ultra-violet light resistant polycarbonate. Sign shall read "PUSH FOR HELP " in both standard English and Braille for ADA compliance. Sign shall also give instructions according to the ADA Guidelines.

PART 16 - WARRANTY

- 16.1 Equipment shall be warrantied against any defects in material and workmanship, under normal use, for a period of twenty-four months from date of installation. In the event system is found by manufacturer to be defective within the warranty period, manufacturer shall repair and/or replace any defective parts, provided the equipment is returned to manufacturer.

PART 17 - MANUFACTURER

- 17.1 The Manufacturer shall be Talk-A-Phone Co. (773) 539-1100, 7530 N. Natchez Ave, Niles, Illinois 60714-3804, [www.talkaphone.com](http://www.talkaphone.com). THERE ARE NO EQUIVALENTS.

END OF SECTION 27 51 14

## SECTION 283111 – ADDRESSABLE FIRE ALARM SYSTEM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. General: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION

- A. System: Provide an addressable type fire alarm system as indicated in the contract documents, including all required interconnections to the Owner-provided central station telephone circuit.
- B. Monitor Points: The systems shall incorporate monitor points with alarm verification, and control outputs, from designated devices located throughout the building, and provide point identification of an alarm at the master control console.
- C. Zoning: System devices shall be zoned as indicated on the contract drawings. System devices shall be microprocessor based, utilize digital addressing techniques, and function as described herein.
- D. Supervisory Functions: The system shall provide control and supervision of all system functions and, in conjunction with addressable analog sensors and circuit modules, provide information, which is translated into the processor.
- E. Memory: The execution of custom requirements shall take place through non-volatile rom memory, which shall maintain the system configuration even when AC power and battery back-up power is lost.
- F. The system shall feature positive alarm sequence to allow trained personnel 180 seconds to verify alarm after acknowledgement prior to initializing audible and visual alarms. System shall initialize alarms if alarm is not verified in 180 seconds or after 15 seconds if alarm is not acknowledged.
- G. Codes: This system shall be fully usable as a UL listed fire alarm system and shall conform to all state and local codes covering this project.

#### 1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms shall be regularly engaged in manufacture of equipment of types and service required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Testing: Fully test all control panels for proper operation prior to shipment from the factory.
- C. Manufacturer: Equipment design shall be as manufactured by Simplex, Notifier, EST and Siemens.
- D. Installer: The installing firm shall have at least 3 years of successful supplying and installation experience on projects with electrical installation work similar to that required for the project.

- E. Installation: The Contractor, shall provide all conduit, cable, equipment, accessories and materials as detailed in the manufacturer's installation manual and required for the satisfactory operation of the fire alarm system, the elevator detection system, mechanical systems control, and the interface between components and systems.
- F. Equipment Certification: All fire alarm equipment, including accessories to the system and including all wires and cable unless otherwise noted, shall be listed Underwriters Laboratories and Factory Mutual.
- G. Single Manufacturer: List each and every item of the Fire Alarm System as a product of single alarm system manufacturer complying with the standards as specified herein.
- H. Warranty Acceptance: The Contractor must warranty service and make available to the Owner, a duly authorized and franchised distributor who shall service the fire alarm system and supply on-the-premise maintenance by factory trained service technicians during normal working hours.
- I. Warranty Period: The Contractor shall provide maintenance at no additional cost to the Owner for a period of 12 months from the date of substantial completion of the installation. Maintenance shall be for the standard use of the system and does not include damage caused by natural forces or physical abuse. The Contractor shall also agree that service, when provided at other than normal working hours, shall be made at a normal working hours labor rate.
- J. Yearly Tests: The Contractor shall, at no expense to the Owner, observe the systems in operation and conduct tests to assure that systems are performing in full compliance with specified requirements at least twice during the initial 6 months of operation. The testing shall be coordinated with a designated Owners representative, at a time convenient to the Owner, with results reported in writing to the Owner.
- K. Maintenance Contract: Make available to the owner, a maintenance contract proposal to provide a minimum of 2 inspections and tests per year, in compliance with NFPA-72 guidelines.
- L. Standards: Comply with the following standards as they apply to Fire Alarm Systems:
  - 1. UL 217 Single and Multiple Station Smoke Detectors.
  - 2. UL 268 Smoke Detectors for Fire Protection Signaling Systems.
  - 3. UL 268A Smoke Detector for Duct Applications.
  - 4. UL 864 Standard for Control Units for Fire Protective Signaling System.
  - 5. NFPA 72
  - 6. NFPA 101

#### 1.4 SUBMITTALS

- A. Shop Drawings: Shop drawings shall be complete showing all wiring diagrams, and point to point connections required for this project. The point to point connections shall be indicated on drawings showing routing of raceways, connections, components, and conductor quantities and types. The Contractor shall apply his company name, address, telephone number, etc. on an individual title block indicating "This drawing for fire alarm wiring only". Computer CAD drawings are required.
- B. Product Data: Submit manufacturer's standard catalog data on all components and sub-systems. Product data shall be submitted showing manufacturer's written recommendations for storage and protection, and installation instructions. Manufacturer's product data shall be submitted for all system equipment including;
  - 1. Application information
  - 2. Dimensions
  - 3. Listing agency file



4. Wiring diagrams
5. Installation information

## 1.5 PRODUCT STORAGE AND HANDLING

- A. Protection: Physically protect smoke and heat detectors against damage as recommended by manufacturer. Minimize exposure of detectors to dirt and dust from construction. Provide plastic covers during construction. Remove covers after the project has been cleaned and is ready for operation. Testing must be done after the removal of protective covers.
- B. Packaging: Store equipment in original packaging. Store inside well ventilated area protected from weather, moisture, dust, extreme temperatures, and humidity.
- C. Damage: Remove and replace with new, all broken pull stations, detectors, annunciation devices and other accessories, damaged before final acceptance at no additional expense to the contract. No allowance shall be made for breakage or theft before final acceptance.

## PART 2 - PRODUCTS

### 2.1 SYSTEM OPERATION

- A. Manual: Upon activation of the fire alarm system by any manual initiating device, including manual pull stations, the system shall initiate the positive alarm sequence to allow verification of alarm. If the alarm is failed to be acknowledged (15 seconds), identified as positive, or failed to be identified within 180 seconds, or another alarm is initiated, the following shall take place:
  1. Sound the audible fire alarm signals throughout the building.
  2. Flash the visual fire alarm signals throughout the building.
  3. Alert the local fire department via the owner provided monitoring service.
  4. Release all doors held open by electro-mechanical release devices in the zone or area in alarm and in each adjacent area or zone.
  5. Cause the alarm location to be displayed on the local system control panel, the main fire alarm control console, and all remote annunciators and printers.
- B. Automatic: Upon activation of the fire alarm system by any smoke detector or other automatic detection device, the system shall initiate the positive alarm sequence to allow verification of alarm. If the alarm is failed to be acknowledged (15 seconds), identified as positive, or failed to be identified within 180 seconds, or another alarm is initiated, the following shall take place:
- C.
  1. Shut down all air handlers and exhaust fans supplying or exhausting air in the area or zone where the alarm is initiated and in each adjacent area or zone.
  2. Close all automatic smoke dampers or smoke and fire combination dampers in ducts associated with the air handling units and exhaust fans which will shut down.
  3. Shut down all fan coil units serving exit access corridors.
  4. Activate existing smoke control system as indicated in the Division 15 of these specifications.
- D. Any sprinkler flow alarm shall immediately initiate all functions noted above.
- E. Supervisory: System supervisory faults, such as shorts, opens, and grounds in conductors, operating power failure, or faults within supervised devices, shall cause an audible and visual trouble indication at the control panel. It shall be possible to silence the audible trouble signal. Once the trouble is corrected the signal shall again sound until the silence switch is restored to its normal position.

## 2.2 ADDRESSABLE MANUAL STATIONS

- A. Pull Station: Manual fire alarm pull station shall be semi-flush, non-coded, normally open double action type with single contacts. A downward pull of the lever shall activate a switch to sound the alarms and light the zone lamps at the control panel. Station shall remain actuated until station is reset by means of a special key.
- B. Address: Provide dip switches to set address code to communicate with control panel.
- C. Mounting Height: 48 inches above floor to centerline.

## 2.3 ALARM SIGNALS

- A. Type: General alarm signals shall be supervised slow whoop semi-flush mounted with flashing strobe lights. The device shall be labeled "FIRE" with pre-recorded voice evacuation signal.
- B. Sound Level: Sound pressure level shall be 92 DB at 10 feet across the frequency range of 400 to 4,000 Hz.
- C. Lamp: Rate to peak light intensity shall be minimum 15 candela for the DC strobe. Flash lamp at a rate of 1 flash per second.
- D. Mounting Height: Signaling devices shall be mounted no lower than 80 inches above floor to bottom of the device or 6" below ceiling, whichever is lower.
- E. Sound and Light Intensity: Sound level and light intensity shall conform to ADA standards. Light intensity shall be as noted on drawings.
- F. Alarm Silence: Strobes shall continue to flash after alarm has been acknowledged. Devices shall be 4-wire.
- G. Addressable strobes may be used as an option.

## 2.4 ADDRESSABLE THERMAL DETECTORS

- A. Usage: Use fixed temperature heat detectors in loading docks, janitors closets, mechanical equipment rooms, and rooms containing steam generating equipment.
- B. Fixed Temperature Heat Detectors: Provide automatic heat detectors of 135 degrees F. fixed temperature where heat detectors are indicated on the drawings. Provide each detector with integral indicators to indicate polling and if fixed temperature rating of the device has been exceeded. Certain locations noted, including all mechanical rooms, shall contain 190 degrees F. fixed temperature type.
- C. Detector Base: The base shall be equipped with a mechanism to lock heat detector into base.
- D. Elevator Shaft Detectors: Provide fixed temperature 135 degrees F. heat detectors for elevator shaft locations, and elevator equipment rooms.
- E. Weather Proof Heat Detectors shall be used in ambient conditions that require Weather Proof UL listing because of ambient humidity.

## 2.5 AUTOMATICALLY ADJUSTABLE ADDRESSABLE SMOKE DETECTORS

- A. General: The detector shall not require replacement or readjustment after a fire alarm has been given. Two LED's indicate the presence of polling and alarm conditions. Equip detector with dip switches to set addressable codes to communicate with the control panel. The detectors shall be listed for both ceiling and wall mount applications.
- B. Sensitivity: The detector sensitivity shall be individually adjustable and set by the software program of the fire alarm control panel and shall communicate actual smoke chamber values to the system control. Sensors shall have no self contained alarm set point (fixed threshold) or addressable setting ability. The detector shall communicate actual smoke chamber values to the system control. The detector shall automatically compensate for environmental changes.
- C. Wiring: Wire detectors for alarm annunciation and supervision to allow the removal of any detector without disturbing the alarm capability or supervision of any other detector.
- D. Photoelectric Smoke Detectors: Photoelectric type smoke detectors shall communicate actual smoke chamber values to the system control panel.
- E. Photoelectric Smoke Detector Manufacturer: Detector shall be as manufactured by Simplex.
- F. Duct Photoelectric Smoke Detectors: The duct smoke detectors shall be photoelectric and shall communicate actual smoke chamber values to the system control. The duct housing shall contain an LED which shall pulse to indicate power on and glow continuously to indicate an alarm or detector trouble condition. The lamp in the detector and at the remote alarm lamps shall light to indicate the initiation of the alarm. Detector, when duct-mounted, shall be mounted on sheet metal collar installed in duct so that detector is firmly secured even after repeated removal.

2.6

## 2.7 REMOTE ALARM LAMPS

- A. Location: A red remote flush alarm light shall be provided for each duct or concealed detector, adjacent to it's location, in a public space, to annunciate smoke detector operation remotely. Where multiple lamps are shown, all lamps shall be mounted on a single plate.
- B. Identification: Label shall be red with white lettering, 3/4 inch high. Refer to Identification section of the specification.
- C. Mounting Height: 84 inches above floor to centerline.

## 2.8 AIR HANDLING SYSTEM SHUTDOWN ADDRESSIBLE MODULE

- A. Operation: Provide a data addressable module at each air handling system and exhaust fan for shutdown on alarm from the fire alarm system as per the systems operation description. The unit shall be wired such that it shall be self monitoring for integrity. A failure of the relay or associated wiring shall cause unit shutdown. The coil voltage of the relay shall match the fire alarm control panel voltage and a fire alarm signal shall initiate interruption of the air handling unit starting circuit.

## 2.9 SMOKE DAMPERS

- A. Operation: Smoke Dampers or combination Smoke and Fire Dampers shall operate as specified herein.

- B. Power: Power for electrically operated Smoke Dampers or combination Smoke and Fire Dampers shall be from the same power source as the Air Handling Unit or Exhaust Fan where the associated duct is controlled by that damper. Shut down of Air Handling Unit or Exhaust Fan for servicing shall cause associated dampers to close.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF CEILING DETECTORS

- A. General: All ceiling mounted detectors shall be installed in accordance with requirements of NFPA 72. Detectors shall be positioned to avoid drafts from supply air diffusers and an adequate distance from equipment producing sudden temperature changes which would result in nuisance false alarms. Ceiling smoke detectors shall be so located as to not allow supply air grills to impede the effective operation of the detector. Position detector a minimum of 3 feet from supply air grills.
- B. Spacing: The corridor system layout shall maintain a maximum 30 feet on center and 15 feet from the ends of all corridors spacing. Additional detectors shall be located within 5 feet and no closer than 12 inches of doors in smoke walls.
- C. Protection: Provide temporary protection for all detectors installed prior to completion of construction.
- D. Location: Locate smoke detectors a minimum of at least 15 feet from any type of furnace, hot water heater, or a gas space heater.

### 3.2 INSTALLATION OF DUCT DETECTORS

- A. General: Installation of duct mounted smoke detector housings and sampling tubes within the supply and return air ductwork shall be done by an experienced sheet metal worker.
- B. Location: Detector shall be mounted at least 6 duct widths downstream, from any duct opening, deflection plates, sharp bends or branch connections. Provide air pressure differential test data to engineer in areas where distance is limited by physical restraints.
- C. Assurance: Proper air velocities shall be maintained per the manufacturer's specifications.
- D. Wiring: It shall be the Contractor's responsibility to provide the proper backbox and sampling tubes for installation within the ductwork. All electrical connections shall be completed by the Fire Alarm Contractor as required for a complete system.
- E. Access: Provide access panels in ductwork to afford proper service and maintenance of the duct detector.

### 3.3 DOORS IN SMOKE WALLS

- A. Hold Open Devices: All doors in smoke walls shall be required to have magnetic door hold open devices. Doors normally kept closed or locked such as toilets, dressing rooms, closets, and mechanical/electrical rooms. Do not require hold-open devices.
- B. Type: Contractor shall review all doors in the smoke walls to determine the most appropriate type of door holder. Doors with no convenient adjacent wall require the installation of header type units.

- C. Identification: Doors in smoke walls not protected by magnetic hold-open devices shall be brought to the attention of the Engineer and be provided with a sign, mounted at normal viewing height with the following statement: "Fire Door - Keep Closed At All Times" The sign shall be of laminated plastic with 2 inches high minimum letters, red on white background. The sign shall be permanently secured to the door with brass screws minimum #4.
- D. Smoke Detectors: Smoke detectors located at doors in smoke walls shall be located no further than 5 feet and no less than 1 foot from the door.

### 3.4 INSPECTIONS AND INSTALLATION TESTING

- A. Local Authority Having Jurisdiction: Equipment shall be installed and located in accordance with requirements of the local authority having jurisdiction.
- B. Demonstration: Upon completion of installation and inspection by the Contractor, an authorized Owner representative shall physically inspect the installed equipment, workmanship, and witness Contractor performed acceptance tests of the fire alarm systems that demonstrate compliance to specifications.
- C. Personnel: The Contractor shall provide equipment and personnel as required for acceptance tests and any tests required by inspecting authorities.
- D. Deficiencies: The Contractor shall correct all system deficiencies and make all necessary adjustments at no cost to the Owner. Perform another acceptance test after correction of deficiencies.
- E. Notification: Before proceeding with any testing, inform the staff of the location where the alarm signal will sound to prevent any unnecessary action. At the conclusion of testing, those previously notified (and others necessary) shall be further notified that testing has been concluded.
- F. Hazardous Locations: Any method or device used for sensing in an atmosphere or process classified as hazardous by Article 500 of NFPA 70, National Electrical code, shall be listed, and suitable for such use.
- G. Reports: Records of all inspections and tests shall be made and submitted at the conclusion of the work.

### 3.5 SMOKE DETECTOR SENSITIVITY TESTING

- A. Testing: Sensitivity settings shall be recorded for all heads and submitted to Engineer at completion.
- B. Reporting: Utilize "Detector Sensitivity Report" included at the end of these specifications for recording test results.
- C. Testing of Existing Equipment: Inspections and tests of existing equipment shall be performed to insure that all control functions, operating panels, annunciation devices and each detector is in reliable operating condition. This equipment shall be connected to the new system so all control functions; annunciation, etc. operate as one system.

### 3.6 HEAT DETECTOR TESTING

- A. Procedure: A restorable heat detector and the restorable element of a combination detector shall be tested by exposing the detector to a heat source, such as a shielded heat lamp, until it responds. After each heat test, the detector shall reset.

- B. Precaution: Precaution shall be taken to avoid damage to the non-restorable fixed temperature element of a combination rate-of-rise fixed temperature detector. The manufacturer's instructions shall be followed.

### 3.7 SMOKE DETECTOR TESTING

- A. Response: To assure that each smoke detector is operative and produces the intended response, it shall be caused to initiate an alarm at its installed location with smoke or other aerosol, acceptable to the manufacturer, that demonstrates that smoke can enter the chamber and initiate an alarm.
- B. Method: To assure that each smoke detector is within its listed and marked sensitivity range, it shall be tested using either one of the following;
  - 1. A calibrated test method.
  - 2. The manufacturer's calibrated sensitivity test instrument.
  - 3. Listed control equipment arranged for the purpose.
  - 4. Other calibrated sensitivity test method acceptable to the authority having jurisdiction.
- C. Range: Detectors found to have a sensitivity outside the accepted range shall be replaced.
- D. Exception: Detectors listed as field adjustable may be either adjusted within an accepted range or replaced. Note: The detector sensitivity cannot be tested or measured using any spray device that administers an unmeasured concentration of aerosol into the detector.

### 3.8 CLEANING

A.Method: Clean all detectors and remove dust or dirt that has accumulated. For each detector, the cleaning, checking, operating, and sensitivity adjustment shall be attempted only after consulting the manufacturer's instructions. These instructions shall detail methods such as vacuuming to remove loose dust and insects and washing to remove heavy grease and grime deposits. In lieu of these cleaning methods, the manufacturer may provide cleaning service at the field location. Following partial disassembly or washing of the detector to remove contamination, the appropriate sensitivity test required shall be performed.

END OF SECTION 28 31 11

INSPECTION AND TESTING FORM  
DATE:

TIME:

SERVICE ORGANIZATION

PROPERTY NAME (USER)

NAME: \_\_\_\_\_

NAME: \_\_\_\_\_

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

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

REPRESENTATIVE: \_\_\_\_\_

OWNER CONTRACT: \_\_\_\_\_

LICENSE NO.: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

MONITORING ENTITY

APPROVING AGENCY

APPROVING AGENCY

CONTACT: \_\_\_\_\_

CONTACT: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

TELEPHONE: \_\_\_\_\_

MONITORING ACCOUNT REF. NO.: \_\_\_\_\_

TYPE TRANSMISSION

SERVICE

- ☐ - McCulloh
- ☐ - Multiplex
- ☐ - Digital
- ☐ - Reverse Priority
- ☐ - RF
- ☐ - Other (Specify)

- ☐ - Weekly
- ☐ - Monthly
- ☐ - Quarterly
- ☐ - Semi-Annually
- ☐ - Annually
- ☐ - Other (Specify)

PANEL MANUFACTURE: \_\_\_\_\_ MODEL NO.: \_\_\_\_\_

CIRCUIT STYLES: \_\_\_\_\_

NO. OF CIRCUITS: \_\_\_\_\_

SOFTWARE REV.: \_\_\_\_\_

LAST DATE SYSTEM HAD ANY SERVICE  
PERFORMED: \_\_\_\_\_

LAST DATE THAT ANY SOFTWARE OR CONFIGURATION WAS  
REVISED: \_\_\_\_\_

ALARM INITIATING DEVICES AND CIRCUIT INFORMATION

QTY OF CIRCUIT STYLE

_____	_____	MANUAL STATIONS
_____	_____	ION DETECTORS
_____	_____	PHOTO DETECTORS
_____	_____	DUCT DETECTORS
_____	_____	HEAT DETECTORS
_____	_____	WATERFLOW SWITCHES
_____	_____	SUPERVISORY SWITCHES

\_\_\_\_\_ OTHER:(SPECIFY)\_\_\_\_\_



ALARM INDICATING APPLIANCES AND CIRCUIT INFORMATION

QTY OF	CIRCUIT STYLE	
_____	_____	BELLS
_____	_____	HORNS
_____	_____	CHIMES
_____	_____	STROBES
_____	_____	SPEAKERS
_____	_____	OTHER: (SPECIFY) _____
_____	_____	_____

NO. OF ALARM INDICATING CIRCUITS: \_\_\_\_\_  
ARE CIRCUITS SUPERVISED? ☐ YES ☐ NO

SUPERVISORY SIGNAL INITIATING DEVICES AND CIRCUIT INFORMATION

QTY OF	CIRCUIT STYLE	
_____	_____	BUILDING TEMP.
_____	_____	SITE WATER TEMP.
_____	_____	SITE WATER LEVEL
_____	_____	FIRE PUMP POWER
_____	_____	FIRE PUMP AUTO POSITION
_____	_____	_____ FIRE PUMP OR PUMP
CONTROLLER TROUBLE		
_____	_____	FIRE PUMP RUNNING
_____	_____	GENERATOR IN AUTO POSITION
_____	_____	GENERATOR OR CONTROLLER TROUBLE
_____	_____	SWITCH TRANSFER
_____	_____	GENERATOR ENGINE RUNNING
_____	_____	OTHER: _____

SIGNALING LINE CIRCUITS

Quantity and style (See NFPA 72, Table 3-6.1) of signaling line circuits connected to system:  
Quantity \_\_\_\_\_ Style(s) \_\_\_\_\_

SYSTEM POWER SUPPLIES

a. Primary (Main): Nominal Voltage \_\_\_\_\_, Amps \_\_\_\_\_  
Overcurrent Protection: Type \_\_\_\_\_, Amps \_\_\_\_\_  
Location (Panel Number): \_\_\_\_\_  
Disconnecting Means Location: \_\_\_\_\_

b. Secondary (Standby):  
Storage Battery: Amp-Hr. Rating \_\_\_\_\_  
Calculated capacity to operate system, in hours: \_\_\_\_ 24 \_\_\_\_ 60 \_\_\_\_  
Engine-driven generator dedicated to fire alarm system:  
Location of fuel storage: \_\_\_\_\_

TYPE BATTERY

COMPLETE:	YES	NO	WHO	TIME
BUILDING MANAGEMENT	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
MONITORING AGENCY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> _____	_____
BUILDING OCCUPANTS	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
OTHER (SPECIFY)	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____

THE FOLLOWING DID NOT OPERATE CORRECTLY:

SYSTEM RESTORED TO NORMAL OPERATION: DATE \_\_\_\_\_ TIME \_\_\_\_\_

THIS TESTING WAS PERFORMED IN ACCORDANCE WITH APPLICABLE NFPA STANDARDS.

NAME OF INSPECTOR: \_\_\_\_\_

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

NAME OF OWNER OR REPRESENTATIVE: \_\_\_\_\_

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

- ☐ Dry Cell
- ☐ Nickel Cadmium
- ☐ Sealed Lead-Acid
- ☐ Lead-Acid
- ☐ Other (Specify) \_\_\_\_\_

c. Emergency or standby system used as a backup to primary power supply, instead of using a secondary power supply:

- \_\_\_\_\_ Emergency system described in NFPA 70, Article 700
- \_\_\_\_\_ Legally required standby described in NFPA 70, Article 701
- \_\_\_\_\_ Optional standby system described in NFPA 70, Article 702, which also meets the performance requirements of Article 700 or 701.

#### PRIOR TO ANY TESTING

NOTIFICATIONS ARE MADE:	YES	NO	WHO	TIME
MONITORING ENTITY	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
BUILDING OCCUPANTS	<input type="checkbox"/>	_____	_____	_____
BUILDING MANAGEMENT	<input type="checkbox"/>	_____	_____	_____
OTHER (SPECIFY)	<input type="checkbox"/>	_____	_____	_____
AHJ (NOTIFIED) OF ANY IMPAIRMENTS	<input type="checkbox"/>	_____	_____	_____

#### SYSTEM TESTS AND INSPECTIONS

TYPE	VISUAL	FUNCTIONAL	COMMENTS
CONTROL PANEL	<input type="checkbox"/>	<input type="checkbox"/>	_____
INTERFACE EQ.	<input type="checkbox"/>	<input type="checkbox"/>	_____
LAMPS/LEDS	<input type="checkbox"/>	<input type="checkbox"/>	_____
FUSES	<input type="checkbox"/>	<input type="checkbox"/>	_____
PRIMARY POWER SUPPLY	<input type="checkbox"/>	<input type="checkbox"/>	_____
TROUBLE SIGNALS	<input type="checkbox"/>	<input type="checkbox"/>	_____
DISCONNECT SWITCHES	<input type="checkbox"/>	<input type="checkbox"/>	_____
GROUND FAULT MONITORING	<input type="checkbox"/>	<input type="checkbox"/>	_____

SECONDARY POWER TYPE	VISUAL	FUNCTIONAL	COMMENTS
BATTERY CONDITION	<input type="checkbox"/>	<input type="checkbox"/>	_____
LOAD VOLTAGE	<input type="checkbox"/>	<input type="checkbox"/>	_____
DISCHARGE TEST	<input type="checkbox"/>	<input type="checkbox"/>	_____
CHARGER TEST	<input type="checkbox"/>	<input type="checkbox"/>	_____
SPECIFIC GRAVITY	<input type="checkbox"/>	<input type="checkbox"/>	_____
TRANSIENT SUPPRESSORS	<input type="checkbox"/>	<input type="checkbox"/>	_____
REMOTE ANNUNCIATORS	<input type="checkbox"/>	<input type="checkbox"/>	_____

#### NOTIFICATION APPLIANCES

AUDIBLE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
VISUAL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
SPEAKERS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
VOICE CLARITY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

#### INITIATING AND SUPERVISORY DEVICE TESTS AND INSPECTIONS

DEVICE	VISUAL	FUNCTIONAL	FACTORY	MEA
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OC. & S/N	TYPE	CHECK	TEST	SETTING	SETTING	PASS	FAIL
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____	<input type="checkbox"/>	
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____	<input type="checkbox"/>	
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____	<input type="checkbox"/>	
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____	<input type="checkbox"/>	
_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____	<input type="checkbox"/>	

COMMENTS:

EMERGENCY COMMUNICATIONS EQUIPMENT	VISUAL	FUNCTIONAL COMMENTS
PHONE SET	<input type="checkbox"/>	<input type="checkbox"/>
PHONE JACKS	<input type="checkbox"/>	<input type="checkbox"/>
OFF-HOOK INDICATOR	<input type="checkbox"/>	<input type="checkbox"/>
AMPLIFIER(S)	<input type="checkbox"/>	<input type="checkbox"/>
TONE GENERATOR(S)	<input type="checkbox"/>	<input type="checkbox"/>
CALL IN SIGNAL	<input type="checkbox"/>	<input type="checkbox"/>
SYSTEM PERFORMANCE	<input type="checkbox"/>	<input type="checkbox"/>

DEVICE	SIMULATED	VISUAL	OPERATION	OPERATION
INTERFACE EQUIPMENT				
(SPECIFY)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(SPECIFY)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(SPECIFY)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
SPECIAL HALARD SYSTEMS				
(SPECIFY)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(SPECIFY)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
(SPECIFY)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

SPECIAL PROCEDURES:

COMMENTS:

ON/OFF PREMISES MONITORING:

	YES	NO	TIME	COMMENTS
ALARM SIGNAL	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
ALARM RESTORAL	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
TROUBLE SIGNAL	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
SUPERVISORY SIGNAL	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____
SUPERVISORY RESTORAL	<input type="checkbox"/>	<input type="checkbox"/>	_____	_____

NOTIFICATIONS THAT TESTING IS

- D. Anchor flanges of chute vents to roof curbs before installing roofing and flashing. Install chute-vent counterflashing after roofing and roof-penetration flashing are installed.
- E. Intake and Discharge Doors: Interface door units with throat sections of chutes for safe, snag-resistant, sanitary depositing of materials in chutes.
  - 1. Coordinate installation of foot-pedal door operator with installation of door and the enclosing chase construction.
  - 2. Interconnect sanitizer control with door interlock system.
- F. Test and adjust chute components after installation. Operate doors, locks, and interlock systems to demonstrate that hardware operates properly and smoothly and electrical wiring is connected correctly.
- G. Test heat- and smoke-sensing devices for proper operation.
- H. Operate sanitizing unit through one complete cycle of chute use and cleanup, and replenish chemicals or cleaning fluids in unit containers.
- I. Plumbing Access Doors: After construction of chase enclosure, verify that access doors have been correctly located and properly installed for their purpose.

### 3.2 CLEANING

- A. After completing chase enclosure, clean exposed surfaces of chute system's components. Do not remove labels of testing and inspecting agencies.

### 3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain each chute and related equipment.
- B. Demonstrate replenishment of sanitizing-unit chemicals or cleaning fluids.

END OF SECTION 149182

## SECTION 313116 - TERMITE CONTROL

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Soil treatment for termite control.

#### 1.2 DEFINITIONS

- A. EPA: Environmental Protection Agency.
- B. PCO: Pest control operator.

#### 1.3 SUBMITTALS

- A. Product Data: Treatments and application instructions, including EPA-Registered Label.
- B. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements.
- C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:
1. Date and time of application.
  2. Moisture content of soil before application.
  3. Brand name and manufacturer of termiticide.
  4. Quantity of undiluted termiticide used.
  5. Dilutions, methods, volumes, and rates of application used.
  6. Areas of application.
  7. Water source for application.

#### 1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A pest control operator who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

#### 1.6 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

#### 1.7 WARRANTY

- A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

- 1. Warranty Period: Five years from date of Substantial Completion.

#### 1.8 MAINTENANCE SERVICE

- A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

## PART 2 - PRODUCTS

### 2.1 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate.
  - 1. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

### 3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.



### 3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.
  - 1. Slabs-on-Grade: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  - 2. Foundations: Adjacent soil including soil along entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers, and piers; and along entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
  - 3. Masonry: Treat voids.
  - 4. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.
- F. Post warning signs in areas of application.
- G. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 313116

## SECTION 321400 - UNIT PAVING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Pavers.
  - 2. Waterproofing.

#### 1.2 SUBMITTALS

- A. Product Data: For materials other than water and aggregates.
- B. Product Data: For the following:
  - 1. Pavers.
  - 2. Waterproofing.
- C. Samples for Verification:
  - 1. Full-size units of pavers indicated.
- D. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.
- B. 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.
- C. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

## PART 2 - PRODUCTS

### 2.1 PAVERS

- A. Products and Manufacturers: Match Architect's sample.

### 2.2 ACCESSORIES

- A. Waterproofing:
  - 1. Product and Manufacturer – Basis of Design: Mapelastic 315; Mapei Headquarters of the Americas
- B. Cork Joint Filler: Preformed strips complying with ASTM D 1752, Type II.
- C. Mortar for Setting Pavers:
  - 1. Materials:
    - a. Portland Cement: ASTM C 150, Type I or Type II.
    - b. Hydrated Lime: ASTM C 207, Type S.
    - c. Sand: ASTM C 144.
    - d. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.
    - e. Water: Potable.
  - 2. Mortar Mixes:
    - a. Mortar-Bed Bond Coat: Mix neat cement and latex additive to a creamy consistency.
    - b. Portland Cement-Lime Setting-Bed Mortar: Type M complying with ASTM C 270, Proportion Specification.

### 2.3 AGGREGATE SETTING-BED MATERIALS

- A. Aggregate for Base: Sound, crushed stone or gravel complying with ASTM D 448 for Size No. 8.
- B. Sand for Leveling Course: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C 33 for fine aggregate.
- C. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas indicated to receive paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

### 3.3 INSTALLATION, GENERAL

- A. Install waterproofing in accordance with manufacturer's instructions and recommendations.
- B. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.
- C. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.
- D. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- E. Joint Pattern: As indicated.
- F. Tolerances: Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.
- G. Mortar set unit pavers as needed.

### 3.4 AGGREGATE SETTING-BED APPLICATIONS

- A. Compact soil subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.
- B. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

- C. Place separation geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- D. Place aggregate subbase and base, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.
- E. Place geotextile fabric overlapping ends and edges at least 12 inches.
- F. Place leveling course and screed to a thickness of 1 to 1-1/2 inches, taking care that moisture content remains constant and density is loose and uniform until pavers are set and compacted.
- G. Treat leveling course with herbicide to inhibit growth of grass and weeds.
- H. Set pavers with a minimum joint width of 1/16 inch and a maximum of 1/8 inch, being careful not to disturb leveling base. If pavers have spacer bars, place pavers hand tight against spacer bars. Use string lines to keep straight lines. Fill gaps between units that exceed 3/8 inch with pieces cut to fit from full-size unit pavers.
  - 1. When installation is performed with mechanical equipment, use only unit pavers with spacer bars on sides of each unit.
- I. Vibrate pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
  - 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches of uncompacted pavers adjacent to temporary edges.
  - 2. Before ending each day's work, compact installed concrete pavers except for 36-inch width of uncompacted pavers adjacent to temporary edges (laying faces).
  - 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches of laying face.
  - 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and cover leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
- J. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.
- K. Do not allow traffic on installed pavers until sand has been vibrated into joints.
- L. Repeat joint-filling process 30 days later.

### 3.5 REPAIRING AND CLEANING

- A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.
- B. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.
  - 1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
  - 2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 321400

## SECTION 321813 - ARTIFICIAL TURF

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. Section Includes:

1. Artificial turf.

#### 1.2 SUBMITTALS

- A. Product Data: For products indicated.
- B. Samples: For the following. Label each Sample with manufacturer's name, material description, and designation indicated on Drawings.
1. Artificial Turf: 12-inch- square Sample.
- C. Material Test Reports: For artificial turf.
- D. Maintenance Instructions: Manufacturer's recommended procedures.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who is certified by the artificial turf manufacturer to install artificial turf indicated.
- B. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. General: Comply with manufacturer's instructions and recommendations.

### PART 2 - PRODUCTS

#### 2.1 ARTIFICIAL TURF

- A. Product and Manufacturer – Basis of Design: Refer to the Finish Legend.

#### 2.2 INSTALLATION ACCESSORIES

- A. Adhesives: Type recommended by the manufacture for installation indicated.

- B. Seaming Glue and Seaming Cloth: Type recommended by the manufacture for installation indicated.
- C. Fasteners: Provide fasteners of size and type required for applications indicated.
  - 1. Use 300 Series stainless steel fasteners.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with installation requirements. Examine artificial turf for type, color, and potential defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Comply with manufacturer's instructions and recommendations.

#### 3.3 CLEANUP AND PROTECTION

- A. Perform the following operations immediately after installing artificial turf:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by artificial turf manufacturer.
- B. Protect artificial turf against damage from construction operations during the remainder of construction period. Use protection methods indicated or recommended in writing by artificial turf manufacturer.

END OF SECTION 321813